container such as a five gallon bucket. In the Northeastern United States, the typical rental cost for this equipment is between $500 and $4,500 a week, depending on the size shaker desired. It may be possible to get more information on rentals for this type of equipment from heavy equipment rental companies.

Another possible option is to rent a vacuum system that will collect the lead shot-containing soil from the range. Here, vacuuming takes the place of hand raking or sweeping. A vacuum machine is used to collect the lead shot-containing soil. Once collected, the lead shot-containing soil must be sifted through a screening system (either a rental screening machine, or a series of home made framed screen sets). You may be able to obtain more information about renting vacuums or vacuuming services (e.g., it may include a person to operate the machinery) from heavy equipment rental companies.

Some clubs have found that performing their own lead reclamation to be very time consuming. Part of the reason these reclamations took so long is that the soils were wet. Reclamation is much easier under dry soil conditions. For example, one club reclaimed lead from their range using equipment they modified themselves. Twenty-five tons of lead were collected but the reclamation took over two years. Another club took a year to reclaim 10 tons of lead. A more preferable option may be to hire a reclamation company.

3.3.3 Hiring a Professional Reclamation Company

Another option for lead removal is to hire a professional reclaimer. Lead reclamation companies claim to recover 75%-95% of the lead in the soils. Generally, with reclamation companies there is no minimum range size requirement for lead reclamation. Concentration of lead is more important than quantity spread over a field, especially if it is a difficult range for reclamation (e.g., hilly, rocky, a lot of clay in the soil).

Please note that reclamation companies tend to be in high demand — it may take over a year for the company to start at your club. Therefore, it is wise to plan ahead and make the call to the reclamation company as early as possible.

Some reclamation companies require a site visit to view the topography, the soil composition, and amount of lead observed on the ground. During the visit, some companies may even do a site analysis to determine whether or not it is feasible to reclaim. This analysis identifies the location of lead, the expected recovery amount, and the depth lead reaches into the soils.

3.3.4 Reclamation Activities

Using machinery to reclaim lead usually requires that the area be clear of scrub vegetation. Grass, mulch, or compost is generally removed or destroyed during the reclamation process. Some reclamation companies have no problem beginning reclamation on a grassy field. Other reclamation companies will remove grass before or during reclamation (by burning it, if allowed locally, leaving behind the lead shot), and still others require that all vegetation be removed before they arrive at the range. Some companies will re-seed the area once the reclamation is completed.

Since sporting clay ranges generally have many trees, removal of vegetation as discussed above may not directly apply to existing sporting clay ranges. At these ranges, the focus is on removing vegetative debris (i.e., fallen limbs, tree bark, etc.) prior to reclamation. This may include removing some trees to gain better access with the reclamation machinery. Of course, when designing a new sporting clay range, steps to facilitate lead reclamation should be taken into account. For example, less and more widely spaced trees will facilitate lead reclamation.

Reclamation companies use several types of machinery to reclaim lead. Some companies drive their separation machinery over the site. The lead-laden soil is picked up, processed and then returned to the ground after most of the lead

is removed. Other companies scrape off the top several inches of soil from the ground, using a front-end loader to bring the soil/lead to stationary reclamation machines, and then return the soil to the field after reclamation. Many companies till the top two to five inches of soil and grass immediately prior to reclamation to facilitate the process (some companies may require this to be done prior to arrival on the range).

Regardless of how it is collected, the actual reclamation of the lead follows the same general pattern. Most often, it is sifted through a series of shaking screens. The lead and soil pass through shaking screens (usually at least two screens) of decreasing mesh (hole) size, with the topmost screen having the largest mesh. This part of the reclamation machinery is usually adapted from machinery used for potato or gravel sizing.

Any soil/debris automatically screened out as being too big or too small is either returned to the field or re-screened to ensure no lead is caught in the debris. This procedure is why moist, clay soils are more difficult to reclaim. The moist, clay soils can bind together into shot-sized pellets producing more "product" for the second part of the reclamation. The wet soils can also clog the screens.

For some reclamation companies, their process ends after sifting the soil and returning it to the ground. However, some companies take reclamation one step further. After screening, the resulting lead, soil, and other lead-sized particles enter a blowing system. Here the lead shot is easily separated from the soil and other debris by the blowing air. The lead is much more dense than the soil and other lead-sized debris so that it falls out first. Figure 3-3 depict examples of actual lead reclamation machinery.

Some lead reclamation companies will perform the reclamation during club off-hours so that club activities are not interrupted. Additionally, some perform the reclamation on a field-by-field basis, to minimize any disruptions to club activities. However, others companies require the club to shut down during the reclamation.

Reclamation time varies depending on weather, site accessibility, range size, and number of personnel assigned to perform the reclamation.

Reclamation activities may generate dust, especially in drier western locations. To prevent or minimize dust from traveling off the range and causing complaints from neighbors, reclamation activities generating dust should only be conducted during periods of no wind. In addition, such activities should be completed as quickly as possible.

Vacuuming

For ranges that are located on hilly, rocky, and/or densely vegetated terrain, several reclamation companies employ a vacuum system that collects the lead shot (and soil and other detritus). The resulting mix is then placed into the reclamation machinery discussed above. This method is especially effective for sporting clay ranges where lead shot tends to pile up around tree bases.

Vacuuming has traditionally been used for removal of lead shot from trap, skeet and sporting clay ranges. Another way to apply this method involves removing the top layer of an earthen backstop or sand trap with shovels. It is then spread thinly over an impermeable material such as plywood. A vacuuming device is then used to collect the materials that are lighter than lead (e.g., sand or soil), while leaving behind the heavier materials (i.e., lead bullets/shots and fragments). The soil can then be returned to the range. This process is most efficient for dry, sandy soils without a lot of organic material. A more recent innovation is the use of a high suction vacuum. This vacuum itself does not have to be moved about, since a very long hose (up to 600 feet) is used to move in and around trees during the collection of lead shot at trap and skeet ranges.

Soil Washing (Physical and Gravity Separation)

Soil washing is a proven technology and another lead reclamation method used by some reclaimers to separate the lead particles from

the soils. Soil washing is the separation of soils into its constituent particles of gravel, sand, silt and clay. Because of the much higher surface area and surface binding properties of clay, most lead contaminants tend to adhere to the clay particles.

Soil washing, therefore, attempts to generate a clean sand and gravel fraction by removing any fines adhering to the larger soil particles and, if necessary, to transfer contaminants bound to the surface of the larger particles to the smaller soil particles. Typically, the soils are first excavated from the range and then mixed into a water-based wash solution. The wet soil is then separated using either wet screening or gravity separation techniques. One benefit of this system of reclamation is that it does not require that soils be dry.

In addition, soil washing may be able to recover all or almost all lead particles through a combination of wet screen sizing and density separation. This technique is an option for remediation of a range being closed and may compare favorably from an economic standpoint with the disposal option.

Soils treated using this method have been shown to be below 5 mg/L TCLP and to have up to 99% of particulate lead removed. Treatment costs are site specific, but can range from less then $40 per ton (1999 levels) for simple physical/gravity separation up to about $100 per ton for processes involving leaching. Credits for recycled lead help offset the treatment cost and the cost of recycling any treatment sludges and concentrated soil fines. Water used in soil washing is from a closed loop system and should only be disposed at completion of cleanup. Experience shows the water to not be a RCRA regulated hazardous waste, therefore probably allowing disposal to a local wastewater treatment plant.

Wet Screening

With this method, particles larger and smaller than the surrounding soils are passed through a series of large-mesh to small-mesh screens. Each time the mixture passes through a screen, the volume of the soil mixture is reduced. Large particles such as lead shot/bullets and fragments are screened out of the soil/wash mixture early in the process and can be taken off-site for recycling - allowing the soil to be placed back on-site.

Gravity Separation

This technique can be used in cases where the lead particles are the same size as surrounding soil particles. The wet soil/wash mixture is passed through equipment, which allows the more dense materials (i.e., lead materials) to settle to the bottom of unit and separate out of the soil/wash mixture.

Pneumatic Separation

Pneumatic separation (see figure 3-3) is an effective means to enhance the traditional screening results. Traditional screening cannot separate shot and bullets from other shot and bullet sized material, i.e., rocks, stones, roots, and various debris. A recycling facility considers non-lead items as "contaminants" which drastically reduces the value of the recycled lead. Pneumatic separation utilizes an air stream, and specific density analysis, to effectively separate the shot/bullets from the other shot/bullet sized material.

3.3.5 BMPs to Assist Lead Reclamation and Recycling

There are several operational activities that should be conducted throughout the year to facilitate reclamation. The following is a discussion of these activities.

Frequency of Lead Removal

It is important to perform lead removal at a frequency appropriate for your site. The frequency is dependent on several factors. These include:

- Number of rounds fired
- Soil pH
- Annual precipitation
- Soil Type
- Depth to groundwater.

Lead quantity, as estimated by the number of rounds fired, is a factor in determining the appropriate frequency of reclamation at ranges. It also assists in determining the cost of reclamation. One reclamation company indicated that reclamation was most cost effective when it contains at least 20 pounds of lead per square foot of backstop. Another source indicated that a minimum of 100,000 rounds per firing lane should be allowed before lead reclamation occurs. This would ensure good range operation and maintenance, while minimizing the cost per quantity of lead recovered.

For shotgun ranges, tracking the number of targets thrown can help indicate when the lead shot should be reclaimed. For example, considering environmental issues, the market for scrap lead and common cleanup methods, one source indicated that when a range has thrown at least 250,000 to 1,000,000 targets, depending on the shooting area, reclamation of the lead shot is encouraged. Another reclaimer indicated that if at least two pounds of lead per square foot have accumulated on the range, reclamation is recommended.

Because the number of rounds fired is important to know, establishing record keeping procedures to monitor the number of rounds fired is recommended. This can be accomplished by maintaining logbooks and asking shooters to list the number of rounds shot and the type/size of shot/bullets they use. This should be done by lane and by stand.

There are many ranges at which lead removal has not occurred for many years. Many of these ranges are used extensively. Such ranges are especially good candidates for lead removal and recycling. Subsequent removal frequency depends on range use and environmental factors. The NRA recommends a frequency of one to five years for lead cleanup, even on ranges with minimal use[4]. One possible approach to reducing the cost of reclamation more cost effective is for a number of ranges in the same geographical area to work together in organizing coordinated removals at their ranges. This will reduce the reclaimer travel and mobilization cost for each range.

4. National Rifle Association, "Metallic "Bullets" lead Deposits on Outdoor and Indoor Firing Ranges" 1991

Minimization of Vegetation

As discussed previously, vegetation is useful both for controlling the amount of runoff and erosion from the range and inhibiting lead mobility. **However, excessive or unmaintained vegetative cover can interfere with reclamation activities.** For example, large amounts of vegetation impedes the screening and sifting processes used by many reclamation companies. Therefore, prior to reclamation activities, it is best to remove, reduce, or mow excessive vegetation from the area. Once the reclamation has been conducted, quick-growing vegetation such as a rye/fescue grass mix should be replanted. This process should be repeated for each reclamation event.
In addition, heavily wooded areas may inhibit lead reclamation because they are less accessible by heavy reclamation machinery. For ranges that are heavily wooded, it is recommended that you minimize the vegetation or modify the range design to allow lead reclamation equipment access to the range. Access to the impact area should be developed to facilitate reclamation. **Make sure that the pathways do not present a safety risk.**

Innovative Landscaping

Some new ranges are landscaping their ranges to include a sand track (an area the size of the shotfall zone that is only sand) located behind some aesthetically pleasing shrubs. This allows the spent shot to concentrate on the sand, making it very easy to perform reclamation because there is no interference by vegetation.

Selecting a Lead Reclaimer

In ensuring that the reclamation is conducted appropriately, selecting a reclaimer that is right for your range is extremely important. Some lead reclamation companies will travel to your range and assess the range prior to conducting

lead collection activities. This assessment trip allows the reclamation company to confirm information gained during initial discussions, as well as to assist in appropriately estimating costs, time required, and the estimated volume of lead at the range. Conducting this pre-assessment also allows you to determine which reclaimer is right for your situation.

Questions Commonly asked by the Reclaimer

When you contact a reclamation company, it is likely that the reclaimer will ask several general questions. Typical questions include:

- When was the last reclamation conducted?
- How many rounds have been shot since that last reclamation?
- What is the use frequency of the range?
- What are the site characteristics and soil types?
- What type of bullet containment device is used at the range?

Answering these questions will be a lot easier if you have maintained good records, as is suggested above.

Questions to ask the reclaimer

When choosing a reclaimer be sure to ask the general questions about prior cleanups (past projects), insurance to cover company and cleanup (general liability insurance, pollution insurance, bonding, etc.), and site plans to ensure health and safety of workers and range personnel. Other questions you may want to ask the reclaimer include:

- Can the reclamation take place outside normal hours of range operation?
- What costs are involved?
- How long will the reclamation take?
- Does vegetation at the range need to be removed?

Economic Considerations

Lead removal costs may vary dramatically depending upon the type and volume of soil or sediments, topography, amount of lead, location, and reclamation company and technique used. Because the economics vary due to many factors, this manual does not provide specific estimates. However, it is important to understand that lead reclamation will generally require an expenditure by the range, even when considering any monetary returns from selling reclaimed lead. By tracking the range use and using the criteria discussed earlier (see Frequency of Lead Removal), the reclamation costs per quantity of lead can be optimized. For long term range management, routine lead removal will help future cost avoidance by minimizing the need for costly site remediation

Some reclaimers bid the lowest flat fee with all the lead provided to the range for selling. The range owners/operators must then consider the transportation costs and recycling fee associated with sending the reclaimed shot and bullets to a recycling company. Alternatively, the reclaimer will use the economic return of lead sold for recycling, based on the volume reclaimed and the current value of lead, to reduce the total cost of reclamation and recycling. Although the value of lead varies, the scrap value of reclaimed lead typically falls between $.06 and $.25 per pound, **excluding transportation cost**. See the appendix for contact information regarding lead reclamation companies that specialize in lead removal at outdoor ranges.

3.4 Documenting Activities and Record Keeping (Step 4)

Documenting activities and keeping good records is of paramount importance for an effective lead management program at a range. Owners/operators should document all activities done at the range with respect to BMPs and recycling of lead. Records should be kept on when services were provided and who provided them.

Owners/operators may want to document what type of BMP(s) were implemented to control lead migration, the date of service, and who did the services. The records should be kept for the life of the range. Records may be used to show that owners/operators are doing their part to

help prevent lead migration off-site and show that they are doing their part to be stewards of the environment.

3.5 Additional Economic Considerations

Not all BMPs need to be implemented at once. Many can be phased in over time. However, it is important to begin implementing BMPs, especially lead reclamation and recycling, as soon as possible. Implementing the most appropriate BMPs for your range requires consideration of your range characteristics and costs associated with implementing the BMPs. This manual provides a large selection of BMPs that vary in both cost and sophistication. In selecting BMPs for your range, it is important to look at all costs and all the benefits (or potential problems) associated with each BMP.

3.6 Summary of Key BMPs for Shooting Ranges

There are several BMPs that are highly recommended to be implemented, if applicable to your range. Table 3-1 identifies the advantages and disadvantages of all BMPs discussed in this chapter. This table serves as a quick reference guide for potential BMPs. Readers should refer back to the detailed discussions above for further information regarding these BMPs.

3.7 Certificate of Recognition

EPA has established a voluntary process whereby a shooting range may apply for a "Certificate of Recognition." The Certificate is intended to be awarded to ranges that have certified that they have prepared and intend to implement, or have implemented, a written Environmental Stewardship Plan that is consistent with the EPA *Best Management Practices for Lead at Outdoor Shooting Ranges* manual. To assist in this process, Appendix E contains a template for an Environmental Stewardship Plan, an electronic copy of which is available on EPA's shooting range website (http://www.epa.gov/region2/leadshot) in several formats. This template, combined with information provided throughout this manual, other resources and guidance, and site-specific factors, will help in guiding the process of evaluating relevant information about your facility and determining which BMP(s) might be appropriate for your ranges. EPA's template was adapted from Appendix C of the National Shooting Sports Foundation's manual, *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges* (the NSSF manual.) Accordingly, use of that template would also be acceptable for use in EPA's Certificate of Recognition program.

In order to request this certificate, a range must submit a notice to the Lead Shot Coordinator in EPA Region 2 stating that they have completed an Environmental Stewardship Plan as indicated above and are intending to implement it within six months. The certificate is intended to convey, to all that may see it, that the range has declared its intention to properly manage lead shot and bullets. However, it must be noted that a certificate is not a permit to operate and provides no additional operational approval, implied or otherwise.

Table 3-1 – Summary of Key BMPs

BMPs for Preventing Lead Migration		
Monitoring and Adjusting pH		
BMP Option	**Advantages**	**Disadvantages**
Lime Spreading	1. Easy 2. Inexpensive 3. Effective	1. Does not offer a permanent solution 2. Will not work in extremely acidic conditions
Immobilizing Lead		
BMP Option	**Advantages**	**Disadvantages**
Phosphate Spreading	1. Easy 2. Inexpensive 3. Effective	1. Does not offer a permanent solution
Controlling Runoff		
BMP Option	**Advantages**	**Disadvantages**
Vegetative Ground Cover (e.g., grass, etc.)	1. Easy 2. Aesthetically pleasing 3. Relatively inexpensive 4. Effectively slows and can redirect runoff 5. Some may "bioabsorb" lead	1. Requires periodic maintenance 2. Must be removed or reduced prior to reclamation 3. Excessive vegetation will interfere with reclamation
Organic Surface Cover (e.g., mulch and compost)	1. Easy 2. Aesthetically pleasing 3. Relatively inexpensive 4. Effectively slows and can redirect runoff	1. Requires periodic maintenance 2. Must be removed prior to reclamation 3. May not be suitable at ranges with acidic soil conditions
Filter Beds	1. Diverts and treats lead contaminated runoff 2. Low maintenance 3. Assists with range drainage	1. May require hiring a licensed engineer 2. Higher initial setup cost

Table 3-1 – Continued

Controlling Runoff (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Water/Sediment Traps	1. Low maintenance 2. Assists with range drainage	1. May require hiring a licensed engineer 2. Higher initial setup cost
Dams and Dikes	1. Low maintenance 2. Assists with range drainage	2. Higher initial setup cost
Ground Contouring	1. Lower initial setup cost 2. Assists with range drainage	1. May require hiring a licensed engineer
Controlling and Containing Bullets		
Bullet Containment Devices		
BMP Option	**Advantages**	**Disadvantages**
Earthen Backstop	1. Minimal (if any) initial setup cost 2. Accepts firing from various guns and directions	1. Build up of bullets increases chances of ricochet and fragmentation problems 2. Lead removal requires mining 3. Potential decreased value of lead because it is less clean than lead reclaimed from other trap systems 4. Does not eliminate lead's introduction into the environment
Sand Trap	1. Low initial setup cost 2. Ease of maintenance 3. Accepts firing from various guns and directions	1. Build up of bullets increases chances of ricochet and fragmentation problems 2. Lead removal requires mining
Pit and Plate Trap (Sand)	1. Low initial setup cost 2. Simple installation 3. Lead removal and recycling requires less extensive mining	1. Lead builds up on top layer of sand causing ricochet problems 2. Increased bullet fragmentation 3. Higher level of maintenance than sand traps

[1] Much of this information was obtained from Action Target's Bullet Containment Trap Technologies video. Reference to various pros and cons of individual bullet containment devices is included in this manual for informational purposes only. The USEPA does not endorse any particular bullet containment device, design, or product.

Table 3-1 – Continued

Controlling and Containing Bullets (Cont.)		
Bullet Containment Devices (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Escalator Trap (Steel)	1. Can be used indoors and outdoors	1. Deflection plates require regular oiling. The oil used is hazardous and can easily migrate at outdoor ranges 2. Relatively high maintenance 3. Poor lead collection because the bullets may become clogged at the spiral collection area at the top of the deflection plate 4. Increased bullet fragmentation 5. May require rubber curtains to be placed in front of the trap to slow bullets 6. More noise 7. Possible creation of lead dust
Vertical Swirl (Steel)	1. Can be used indoors or outdoors 2. Bullets are captured in pure form in containers, thus removal and recycling is easy	1. Does not accept shooting from all directions 2. Corners where each unit meet can cause ricochet and fragmentation problems 3. More noise 4. May create lead dust
Wet Passive Bullet Trap (Steel)	1. Can be used indoors and outdoors 2. Excellent results (i.e., low ricochet, low fragmentation, ease of removal) 3. Bullets are captured in containers, thus removal and recycling is easy	1. Expensive 2. Oil and water mixture is hazardous 3. More noise
Lamella Trap	1. Can be used indoors or outdoors 2. Reduction of lead dust	1. Rubber strips quickly become destroyed and must be replaced 2. Potential fire hazard 3. High maintenance 4. Scattered lead fragments mixed with rubber can migrate; lead contaminated granules are hazardous and require special handling

Table 3-1 – Continued

Controlling and Containing Bullets (Cont)		
Bullet Containment Devices (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Rubber Granule	1. Can be used indoors or outdoors 2. Reduction of lead dust 3. Minimizes fragementation, compared with some backstops	1. Rubber strips can quickly become destroyed and must be replaced 2. Some pose potential fire hazard, although fire-retardant/resistant materials are available in some designs 3. High maintenance 4. Scattered lead fragments mixed with rubber can migrate; lead contaminated granules are hazardous and require special handling
Shock Absorbing Concrete	1. Adaptable/can be formed in any shape 2. Can be used to reduce erosion in soil berms/target emplacements 3. Crushed concrete can potentially be recast after fragments removed	1. Mechanical lifting and handling equipment must be used during installation and maintenance 2. High maintenance (replacement) costs
Removal and Recycling of Lead		
Hand Raking and Sifting	1. Easily done by club members 2. Inexpensive 3. Can be done outside operating hours 4. Relatively effective	1. May be more time consuming at large ranges 2. Weather sensitive (i.e., works best under dry conditions) 3. Exposure to lead and lead dust possible
Screening	1. Effective 2. Potential economic returns	1. Vegetation must be removed 2. Weather sensitive (i.e., works best under dry conditions)
Vacuuming	1. Effective 2. Can be used at least accessible ranges 3. Less vegetation needs to be removed	1. Weather sensitive (i.e., works best under dry conditions)
Soil Washing	1. Effective at cleaning the soil to remove the lead particles so one is left with non-lead soil	1. Vegetation must be removed

References

Battelle Memorial Institute, *Field Demonstration of a Sieving and Stabilization Technology on Lead-Contaminated Soils at a Small Arms Range at Mayport Naval Air Station,* Columbus, Ohio, February 1991

Brister, B. The Speed Factor, Field and Stream, January 1995

Connecticut Coastal Fisherman's Ass'n v. Remington Arms Co., Inc., 989 F.2d 1305 (2d Cir. 1993)

George, C.J., Joachim, A., and Le, Phu Trong, *Long-Buried Lead Shot: Its Stability, Possible Transport by Waterfowl and Reexposure by Hydraulic Dredging at Collins Lake,* Department of Biological Sciences, Union College, Schenectady, NY, June 1991

Long Island Soundkeeper Fund, Inc. v. New York Athletic Club of the City of New York, 1996 U.S. Dist. LEXIS 3383 (S.D.N.Y. 1996)

Magdits, Louis J., *Recycling Regulations*, Proceeding from the Third National Shooting Range Symposium, June 23-25, 1996, Orlando, Florida

Middleton, J.R., *Development of Toxic Free Ammunition,* U.S. Armament Research, Development and Engineering Center

National Rifle Association of America, *Lead Article,* Risk Issues in Health and Safety - Volume I, Pages 6-8, Winter 1990

National Rifle Association of America, *Metallic "Bullets" Lead Deposits on Outdoor and Indoor Firing Ranges*, 1991

National Rifle Association, *The NRA Range Source Book: A Guide to Planning and Construction*, June 1998

National Shooting Sports Foundation, *Environmental Aspects* of Construction and Management of Outdoor Shooting Ranges, June 1998

Ordija, Victor, *Lessons from Lordship*, Proceedings from the National Shooting Range Symposium, October 17-19, 1993, Salt Lake City, Utah

Peddicord, Richard K., *Lead Mobility in Soils*, Proceedings from the Third National Shooting Range Symposium, June 23-25, 1996, Orlando, Florida

Sever, C.W., *Lead and Outdoor Ranges*, Proceedings from the National Range Symposium, October 17-19, 1993, Salt Lake City, Utah

Sporting Arms and Ammunition Manufacturers Institute, Inc., *Lead Mobility at Shooting Ranges,* Newtown, CT, 1996

Stansley, W., Widjeskog, L., and Roscoe, D.E., *Lead Contamination and Mobility in Surface Water Trap and Skeet Ranges,* Bulletin of Environmental Contamination Toxicology, Springer-Verlag, New York, NY, 1992

U.S. Department of the Interior, *Pollution Prevention Handbook -- Firing Ranges,* Department of the Interior, Office of Environmental Affairs, Washington, D.C.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., Directive 9355.4-12, *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, July 14 1994

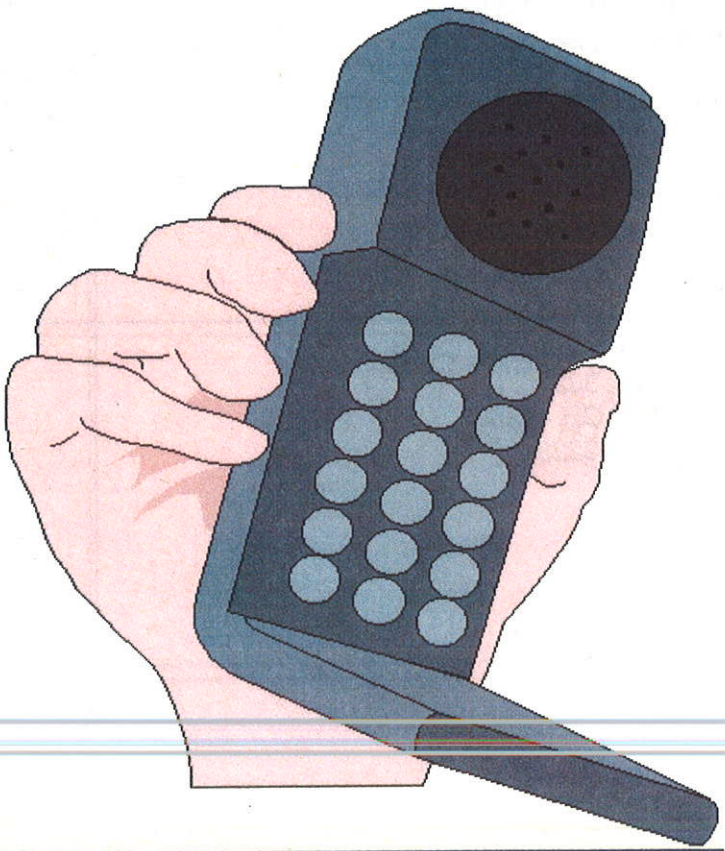
U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington D.C., *A Citizen's Guide to Soil Washing*, EPA 542-F-96-002. , April 1996.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. *Physical/Chemical Treatment Technology Resource Guide*, EPA 542-B-94-008. September 1994.

Appendix A: Resources

This manual provides contacts for lead reclamation companies, lead recycling companies, bullet trap manufacturers, and organizations that provide prevention and/or remediation techniques to assist clubs and firing ranges in implementing Best Management Practices for shooting ranges. The list was updated for the June 2005 printing. Vendors who are interested in being added to the list of lead reclaimers or remediation contractors should contact:

Lead Shot Coordinator
RCRA Compliance Branch
US EPA Region 2
290 Broadway
New York, NY 10007-1866
Telephone: (212)637-4145
E-mail: Leadshot.Region2@epa.gov



Lead Recycling Companies

Below is a list of recycling companies for lead in soils and spent lead shot/bullets that were contacted during the writing of this manual. Lead recycling companies smelt lead. It is not inclusive and is included for informational purposes only. Local scrap metal recyclers may also accept spent lead shot or spent bullets. Mention of these companies does not serve as an endorsement by the EPA.

The Doe Run Company Resource Recycling Divsion HC1 Box 1395 Boss, MO 65440 800-633-8566 573-626-3476 Lou Magdits l.magdits@doerun.com	**East Penn Manufacturing Company, Inc.** P.O. Box 147 Lyon Station, PA 19536 610-682-6361 Rick Leiby Web Site: http://www.eastpenn-deka.com
Exide Spring Valley & Nolan Streets Reading, PA 19612 800-437-8495 Robert Jordan, Maritza Rojas-Suarez Web site: http://www.exide.com	**Gopher Smelting and Refining** 3385 Highway 149 South Eagan, MN 55121 651-454-3310 800-354-7451 Mark Kutoff Web Site: http://www.gopherresource.com/
Gulf Coast Recycling 1901 N. 66th St Tampa, FL 33619 813-626-6151 William Weston	**Kinsbursky Brothers, Inc.** 1314 N. Anaheim Blvd Anaheim, CA 92801 714-738-8516 Paul Schneider Web Site: http://www.kinsbursky.com
Reserve Trading Corp. P.O. Box 302 Medina, OH 44258 330-723-3228	

Lead Reclamation Companies

Below is a list of reclamation companies for lead in soils and spent lead shot/bullets that were contacted during the writing of this manual. Lead reclamation companies reclaim lead from ranges. It is not inclusive and is included for informational purposes only. Mention of these companies does not serve as an endorsement by the EPA.

Brice Environmental 3200 Shell St, P.O. Box 73520, Fairbanks, AK 99707 Craig Jones 907-456-1955 www.briceinc.com Reclaims primarily from earthen backstops and sand traps.	**En·Range, Inc.** 3326 NW 29th St. Miami, FL 33142-6310 Thomas M. Taylor 305-999-9965 Fax 305-635-8645 Email: enrange1@yahoo.com www.en-range.com Provides lead reclamation and other environmental and maintenance services.	**Entact** 1010 Executive Court Suite 280 Westmont, IL 60559 630-986-2900 www.entact.com Performs physical removal of the lead from backstops, chemical treatment of soils and returns soil to the backstop.
Karl & Associates, Inc. 20 Lauck Road Mohnton, PA 19540 Edmund Karl III 610-856-7700 Works primarily in the the mid-Atlantic area. Lead-containing soil is physically removed and sent to licensed disposal sites or licensed recycling facilities.	**MARCOR** 246 Cockeysville Road Hunt Valley, MD 21030 Dave Jungers 410-785-0001 www.marcor.com Uses a pneumatic separation unit to remove lead from contaminated soil and treats soil to pass TCLP.	**Metals Treatment Technologies, LLC (MT^2)** 12441 West 49th Avenue Suite 3 Wheat Ridge, CO 80033 Jim Barthel 303-456-6977 www.metalstt.com Removes lead from soil and treats soils at all types of ranges.
Sears Trucking Company P.O. Box 38 El Reno, OK 73036 Garland Sears 800-522-3314 Fax 405-262-2811 Physically removes lead from soils at trap and skeet ranges.	**Solucorp Industries, Ltd.** 250 West Nyack Road West Nyack, NY 10994 Mike DeLuca 845-623-2333 Fax 845-623-4987 Email: solucorpmbs@aol.com www.solucorpltd.com Removes and treats soil using their Molecular Bonding System (MBS) soil stabilization technology.	**Southern Lead Removal** P.O. Box 2645 Daytona Beach, FL 32115 Kevin Gilchrist 386-763-0115 Fax 386-761-6991 Removes lead from indoor and outdoor pistol ranges only.
Sport Shooting Services P.O. Box 667 Crawfordville, FL 32326 Ed Tyer 850-926-7375 Cellphone 850-294-0132 Email: envirorange@aol.com Removes lead from earthen berms, uses a shaker and screen system to separate lead from soils, rents screening equipment, and consults on range design, primarily in Florida.	**Terra Resources, Ltd.** HC4 Box 9311 Palmer, AK 99645 Larry Wood 907-746-4981 Cellphone: (907) 232-5059 Fax: 907-746-4980 www.terrawash.com Uses gravimetric process to separate lead and TerraWash™ soil washing technology.	**Waste Recycling Solutions, Inc.** 1850 Route 112 Medford, NY 11763 Tommy Arabia, President 631-654-3811 Uses a vacuum system to remove lead from trap and skeet ranges.

Other Resources

Below is a list of additional phone numbers that may be of use if you have general questions including questions on range construction, design, and implementing BMPs.

U.S. Fish and Wildlife Service 4401 North Fairfax Arlington, VA 22203 703/358-2156 Web site: http://www.fws.gov/	**Institute of Scrap Recycling Industies, Inc.** 1325 G Street, NW, Suite 1000 Washington, DC 20005-3104 202/737-1770 Web site: http://www.isri.org/
Lead Industries Association, Inc. 13 Main Street Sparta, NJ 07871 973/726-LEAD (973/726-5323) fax: 973/726-4484 Web site: http://www.leadinfo.com	**National Rifle Association of America** 11250 Waples Mills Road Fairfax, VA 22030 800/NRA-3888 Web site: http://www.nra.org
National Shooting Sports Foundation and National Association of Shooting Ranges 11 Mile Hill Road Newtown, CT 06470 203/426-1320 NSSF web site: http://www.nssf.org NASR web site: http://www.rangeinfo.org	**Sporting Arms and Ammunition Manufacturers' Institute, Inc.** Flintlock Ridge Office Center 11 Mile Hill Road Newtown, CT 06470-2359 203/426-4358 Web site: http://www.saami.org
Wildlife Management Institute 1101 14th Street, N.W. Suite 801 Washington, DC 20005 202/371-1808 Web site: http://www.wildlifemanagementinstitute.org	

Web Resources

Useful Web Sites	
Description	**Web Address**
Federal Government Sites	
U.S. EPA's Outdoor Shooting Range Home Page	http://www.epa.gov/region2/waste/leadshot/
U.S. EPA – Military Munitions Rule	http://www.epa.gov/epaoswer/hazwaste/military/ http://www.epa.gov/tribalmsw/thirds/remunition.htm
U.S. Occupational Safety and Health Administration (OSHA)	http://www.osha.gov/
National Institute for Occupational Safety and Health (NIOSH)	http://www.cdc.gov/niosh/
State Government Sites	
Florida: BMPs for Shooting Ranges	http://www.dep.state.fl.us/waste/categories/shooting_range/
Massachusetts : Lead Shot in the Environment	http://www.state.ma.us/dep/files/pbshot/pb_shot.htm
Minnesota: Poster for "Firing Range Hazards"	http://www.cdc.gov/niosh/mnables.html
Ohio: Lead Shot Reclaimers list	http://www.epa.ohio.gov/dhwm/leadrecy.htm
Wyoming: Lead Recyclers List	http://deq.state.wy.us/outreach/lead.htm
Court Decisions	
Connecticut Coastal Fishermen's Association v. Remington Arms	http://www.duedall.fit.edu/summer/rcra.htm
Long Island Soundkeeper Fund and NY Coastal Fishermen's Assoc. v. New York Athletic Club	http://www.epa.gov/region02/waste/leadshot/lisfnyac.htm
Articles and Research	
USAF - Lead Contamination in Soils at Military Small Arms Firing Ranges	http://www.afcee.brooks.af.mil/pro-act/fact/june98a.asp
U.S. Army Env. Center (AEC) – Small Arms Range Technology	http://aec.army.mil/usaec/range/operations03.html http://aec.army.mil/usaec/technology/rangexxi03.html http://aec.army.mil/usaec/publicaffairs/update/win97/range.htm
AEC – Green Bullets	http://aec.army.mil/usaec/publicaffairs/publicity02.html http://aec.army.mil/usaec/technology/rangexxi00a.html http://aec.army.mil/usaec/publicaffairs/update/spr97/bullets.htm
AEC - Recycling of Firing Range Scrap	http://aec.army.mil/usaec/publicaffairs/update/spr99/spr9911.htm
Florida Center for Solid and Hazardous Waste Management	http://www.floridacenter.org/
National Association of Shooting Ranges' Reference Library	http://www.rangeinfo.org/resource_library/facility_mngmnt/

Bullet Trap Manufacturers[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included In Price	Usage of Trap	Description	General Comments
Action Target (801) 377-8033 Contact: John Curtis, CEO actiontarget.com	Total Containment Trap (TCT)	$1,600 to $1,800 /linear foot (dependent on features selected)	Purchase of Equipment Installation Delivery (Freight included)		Rifle Pistol Armor - piercing* *depends on type of armor-piercing	The TCT is a funnel-style trap that uses steel plates mounted at low angles to direct bullets into a deceleration chamber. The low angles prevent break up of the bullets until they reach the chamber, where the bullets lose energy and drop into removeable storage containers. An optional dust collection unit uses a powerful vacuum to remove lead dust and other fine particles from the collection chamber.	The TCT is designed for both indoor and outdoor applications. It may be used safely with handguns, shotguns, and high-powered rifles, and has been successfully tested and used with 50-caliber fire.
Action Target (Cont.) see details above	Rubber Berm Trap (RBT)	$1100/liner foot	Installation and Delivery		Rifle or Pistol. Armor-piercing. Cannot use incendiary rounds.	The RBT is very similar in form and function to a traditional sand or earthen berm trap, with the obvious difference being the use of chopped rubber instead of sand as a collection medium. Bullets fired into the trap are absorbed by the rubber and remain there until reclamation through mining of lead from the trap.	Because rubber is a softer collection medium, bullets can be captured with less break-up and fragmentation. The resulting reduction in lead dust levels is especially beneficial in indoor ranges. This benefit is decreased as more rounds accumulate in the trap, causing newly fired bullets to impact bullets already in the trap.

1 EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Copius Consultants (516) 783-7489 Contact: Craig Copius	Containment/ Recovery System	Ranges from $600/linear foot to $1,000/linear foot (Price varies with specific design selected)	Purchase of Equipment	Shipping	Rifle Pistol Machine gun Shotgun	This is a modification of the sand backstop. Sizes vary depending on the needs and characteristics of the range; however, average height is 10' - 12' and average width is 12' - 14'. The trap utilizes ballistic grade sand to trap bullets and bullet fragments in a sealed system. The system contains collection and filtration systems to ease reclamation and eliminate off-site migration of lead.	Specific recommended bullet trap is based on the following: 1) Type of usage, quantity of usage, etc. 2) Location in country 3) Environmental issues (e.g., location near a waterbody) Price will depend on the design adopted. One unique feature is that shooting can occur at any angle.
Meggitt Defense Systems Caswell (612) 706-6201 Contact: Brian Danielson	Granular Rubber Bullet Traps	$940 to $1,300/linear foot (dependent on type of trap and other features selected)	Purchase of Equipment Installation Delivery (Freight included)		Pistol Rifle Armor- Piercing Shotgun Machine gun Tracers (Speak to Sales Rep.)	The trap absorbs bullets fired from any angle or distance. No exposed steel surfaces; bullets are not fragmented. The granulated material used in the trap can be turned over quickly to recover the spent rounds.	Suitable for indoor and outdoor ranges. Eight types of traps available. Custom builds traps. Provides site-specific design, if requested. Reclamation is recommended after approximately 90,000 rounds have been fired (depending on trap type.)

1 EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Range Systems (888) 999-1217 (763) 533-9200 Contact Steve Thomas range-systems.com	Encasulator Bloc Trap™ Encasulator Granular Trap™	$800-$1,250/linear ft (Price varies with design criteria and product selection)	Purchase of Equipment Installation	Freight	Pistol Rifle Shotgun (shot and slugs)	The bullet traps are constructed for maximum bullet retention with minumum space and cost. The bullet traps virtually eliminate ricochet and airborne lead.	Full service shooting range provider from design and engineering to construction and maintenance. Custom-built traps with exclusive patented rubber technology.
Savage Range Systems (413) 568-7001 Contact Joan Drucker snailtraps.com	The SNAIL™ Trap	Two types of traps: Pistol Wet: $2,250/linear ft Pistol Dry: $2,150/linear ft Rifle Wet: $2,400/linear ft Rifle Dry: $2,300/linear ft	Purchase of Equipment	Shipping Installation	Rifle (up to .50 cal BMG) Pistol	The SNAIL trap is designed with low angle entrance ramps to guide the bullet into the circular deceleration chamber without scarring the plate. The bullet loses all of its energy in the chamber and drops into a collection system. The use of water and synthetic oil contains the lead particulates and dust, and minimizes friction on the plates.	Usage for indoor and outdoor ranges. Can also be provided with a conveyance system that drops the bullet to a single collection point (e.g., 55-gallon drum) for recycling. Low-maintenance system

1 EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Stapp EBC, Incorporated (703) 239-9223 Contact: Matt Ciskowski, P.E. 8101 Ox Road Fairfax Station, VA 22039 Fax: (703) 239-9224 bulletcatcher.com	STAPP Bullet Catcher	Varies by specific design (measured by square foot)	Purchase of Equipment Installation Delivery (Freight)		Pistol & Rifle (best for calibers up to 12mm) Can handle jacketed rounds and tracers	The STAPP bullet catcher (consisting of a bottom rubber liner, drainpipe reservoir, rubber granule fill, and cover layer of rubber) collects lead and any infiltrating water without runoff. The system is constructed over an earthen berm and can be modified to any range configuration. Projectiles are completely collected by the bullet catcher with minimal fragmentation. The surrounding structure is ricochet-proof even under the most extreme temperatures.	Designs are site adapted. Reclamation can be performed by Stapp EBC or by range personnel. Email: mciskowski-trc@verizon.net

1 EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Super Trap Inc. (951) 736-9440 Contact: Art Fransen, Retired, L.A.S.D. 1601 Commerce St Corona, CA 92880 Fax: (951)736-9450 Email: info@supertrap.com supertrap.com	Gel-Cor™ Class A, Fire-Rated Rubber Bullet Traps ELIxIR™ Tactical Shooting Ranges Super Trap® Range Backstops SACON® Perimeter Facilities, Walls, Blocks & Tiles	Approx $520 to $1,600 per linear foot Varies by design, including: - indoor - outdoor - foundation - width of trap	Purchase of Equipment Installation Training	Shipping (Price will depend on destination)	Rifle & Pistol (up to and including .50 cal) Machine Gun Armor Piercing Tracer & Incendiary Ammunition *Also:* Frangible & Tungsten Traditional & Tactical Shooting	STI specializes in tactical shooting ranges. The firing range system captures and contains bullets whole, using a treated, granular ballistic media of recycled pure SBR (styrene-butadiene rubber), free of all steel and fiber contaminants that could normally allow fires to ignite. The infrastructure is 10 gauge galvanized steel and the hopper/deflection baffle is 3/8" AR 500 steel rifle rated (indoor and outdoor.) Outdoor Ranges: The backstop base typically lies on a graded berm at the appropriate angle determined by the user and STI staff. SACON® can absorb bullets and prevent lead contamination, replacing railroad ties, logs, brick walls and concrete enclosures on firing ranges.	STI's bullet trap systems eliminates hazardous materials contamination (TCLP tests below 1ppm), in addition to preventing ricochets and lead splash-back. Reclamation is recommended after approximately 100,000 to 130,000 rounds per 4 ft lane, based on type of shooter position and layout of targetry (static vs. dynamic.) Lead reclamation is performed using a vacuum air density separator system and rubber media is continuously reused. Use of recycled rubber media in the trap may qualify the range improvement for grant funding. Contact regional recycling associations for more information. STI offers more than six versions of Tactical Shooting Ranges, as well as custom built traps.

1 EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Appendix B: Lead Shot Alternatives

Another method of preventing lead contamination at pistol, rifle, trap, skeet, or sporting clays ranges is to use less toxic or non-lead ammunition.

Much progress has been made in the development of alternatives to lead shot for hunting uses. Information gathered since 1976 on lead poisoning of endangered and non-endangered migratory birds due to lead shot ingestion led the United States Fish and Wildlife Service (USFWS) to consider several alternatives to eliminate lead poisoning among migratory waterfowl birds. A ban on lead shot for water fowl hunting was phased in beginning in 1986 and finalized in 1991. Lead shot is also now banned for shotgun hunting occurring near wetlands in national wildlife refuges. Starting in the fall of 1998, the USFWS banned the use of lead shot in waterfowl production areas. Additionally, many state-managed hunting areas require non-toxic shot for upland/small game hunting.

There are several alternatives to lead shot on the market today and still more alternatives are being developed. Before being used for waterfowl hunting, these alternatives must be approved by the USFWS. Bismuth, steel, tungsten/iron, and tungsten/polymer shots have been approved by the USFWS and additional alternative shot materials are in the USFWS approval process. Most of the ammunition manufacturers in the United States, as well as the military, have developed non-toxic alternatives to lead. Research in Europe may also result in additional non-toxic shot alternatives from which U.S. shooters may choose in the future. The following pages compare lead shot to non-toxic, alternative shot.

Summary of Lead Shot Alternatives†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Lead	$5.00/box $3.00 - $4.00/box of reloaded shells	Standard to which all alternatives are compared	Readily available	Lead is heavy and malleable
Bismuth* 97% Bismuth/ 3% tin	Bismuth shells are packed in 10 round boxes @ $15.00 - $25.00/ 10 round box	Similar to lead	Limited world supply of bismuth	Bismuth is a byproduct of lead and gold mining. There are currently many uses, including: medicine (Pepto-Bismol), cosmetics, pigments, and shotgun shot. The addition of tin makes bismuth more malleable and reduces frangibility. Bismuth shot is safe to use in older firearms.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Steel*	$8.00 - $12.95/box $6.00/box of reloaded shells $15.00/box (copper-plated)	In test performance by the Cooperative North American Shotgun Education Program (CONSEP) in hunting situations, no significant differences were found between lead and steel shot at reasonable distances. Lead is more effective at longer ranges.	Readily available from both domestic and imported sources.	Steel shot is about 33% lighter then lead. Therefore, the initial velocity must be increased so that downrange pellet energy remains similar. In hunting situations, larger, and therefore heavier, steel shot is used. Few shooting competitions allow steel shot at this point, but the number is increasing. While steel target loads are available, shooter perception that steel will adversely affect guns and scoring seems to be the limiting factor in acceptance of steel shot for target shooting. Steel shot will not damage newer guns, but may cause ring bulge in older guns if a very tight choke is used. This problem has been resolved in the newer guns with the use of screw-in chokes.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Contiued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Steel* (cont.)				Another concern with steel shot is safety. Because steel is much less malleable then lead, steel shot is likely to ricochet if it strikes something hard. Lead shot, on the other hand, will deform and flatten. In Europe, steel shot is banned for hunting because it can become embedded in trees. The steel shot in trees cut for lumber can cause damage to sawmill equipment and raise concerns about worker safety. Although steel shot can be reloaded, components are not readily available.
Tungsten/Iron* 40% tungsten/ 60% iron	$62.50/box (tungsten/iron shots are packed in 10 round boxes @ $25.00/10 round box)	Preliminary reports indicate that tungsten/iron shot is as effective as lead shot. However, the amount of shot in each cartridge is significantly less then in typical lead cartridges or even steel cartridges. The density of tungsten/iron is 94% that of lead.	Readily available	The tungsten/iron shot currently available is harder than steel. It would, therefore, cause similar damage to older guns.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Tungsten/polymer Various manufacturers have received final approval from the USFWS to market this type of shot.	Not available yet	Comparable to tungsten/iron	Currently not available	Two ammunition manufacturers are currently producing tungsten/polymer shot. This shot is more malleable than the tungsten/iron alloy and would, therefore, be less damaging to shotguns. A research and development company has developed a tungsten/polymer material as a substitute for lead in all its uses. According to this company, its tungsten/polymer can be formulated to be flexible or stiff, depending on the application. This material has been tested by the US Army in projectiles, but has not been used to manufacture shot. However, the company has initiated the process of applying to the USFWS for approval of this material as non-toxic shot.

† Product reference within this table is not an endorsement by EPA.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Tungsten/steel Same as tungsten/Iron				
Tin USFWS granted temporary approval for 1999-2000 hunting season	Not available yet	Since tin is just being developed as an alternative to lead, performance information is not yet available. However, since the density of tin is less than steel, performance may be less effective than steel.	Currently not available	This material is just being developed as a lead shot alternative. However, it has similar problems as steel in that it is lighter then lead. The International Tin Research Institute in england is developing this product.

Other materials that are currently being experimented with as alternatives to lead are molybdenum and zinc. Not enough information is available to have included these alternatives in the above table.

† Product reference within this table is not an endorsement by EPA.

Summary of Lead Shot Alternatives - Conclusions

The table clearly illustrates that a number of non-toxic alternatives to lead shot exist such as steel and tungsten as well as alloys and synthetic polymers. As demand for shot from these metals increases from migratory waterfowl hunters, it is anticipated that the costs will come down. However, alternatives currently cost approximately two to twenty times more than lead shot.

The ban on lead shot in hunting situations impacts target shooting. The alternatives to lead shot that are now being developed for or are already approved by the USFWS for migratory bird hunting could be considered for use by target shooters.

Although alternatives to lead shot are now being used by hunters, it is rare that the alternatives are used by target shooters. The limiting factors appear to be the expense and performance. All the alternatives to lead are much more expensive, some prohibitively. Unfortunately, the least expensive alternative, steel, is also perceived to be less effective.

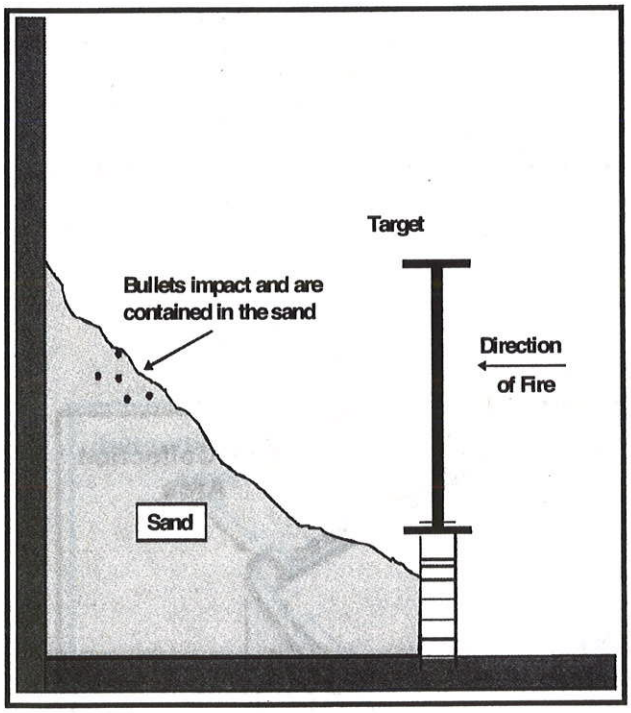
To encourage use of lead shot alternatives, some ranges sponsor shooting competitions using lead-free ammunition, but these are rare. The use of steel or other alternative shot is a recommended BMP in established sporting clays areas at which reclamation of lead shot is difficult to impossible.

Note: Switching to non-toxic shot may create additional issues. For instance, steel has an increased risk of ricochet. Switching to steel may require additional safety features and/or operating procedures.

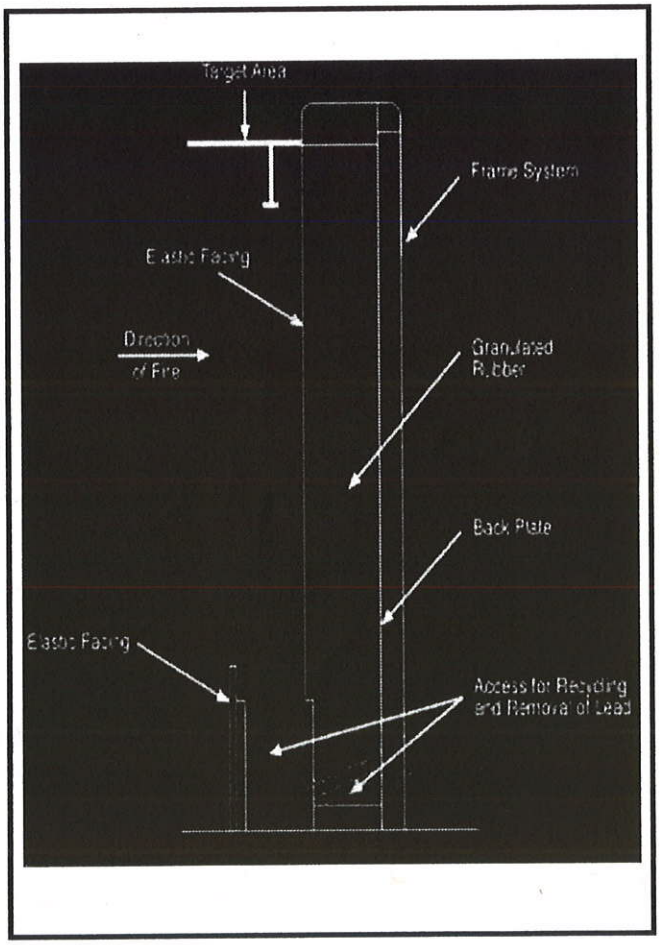
This page intentionally left blank

Appendix C: Sample Bullet Containment Devices

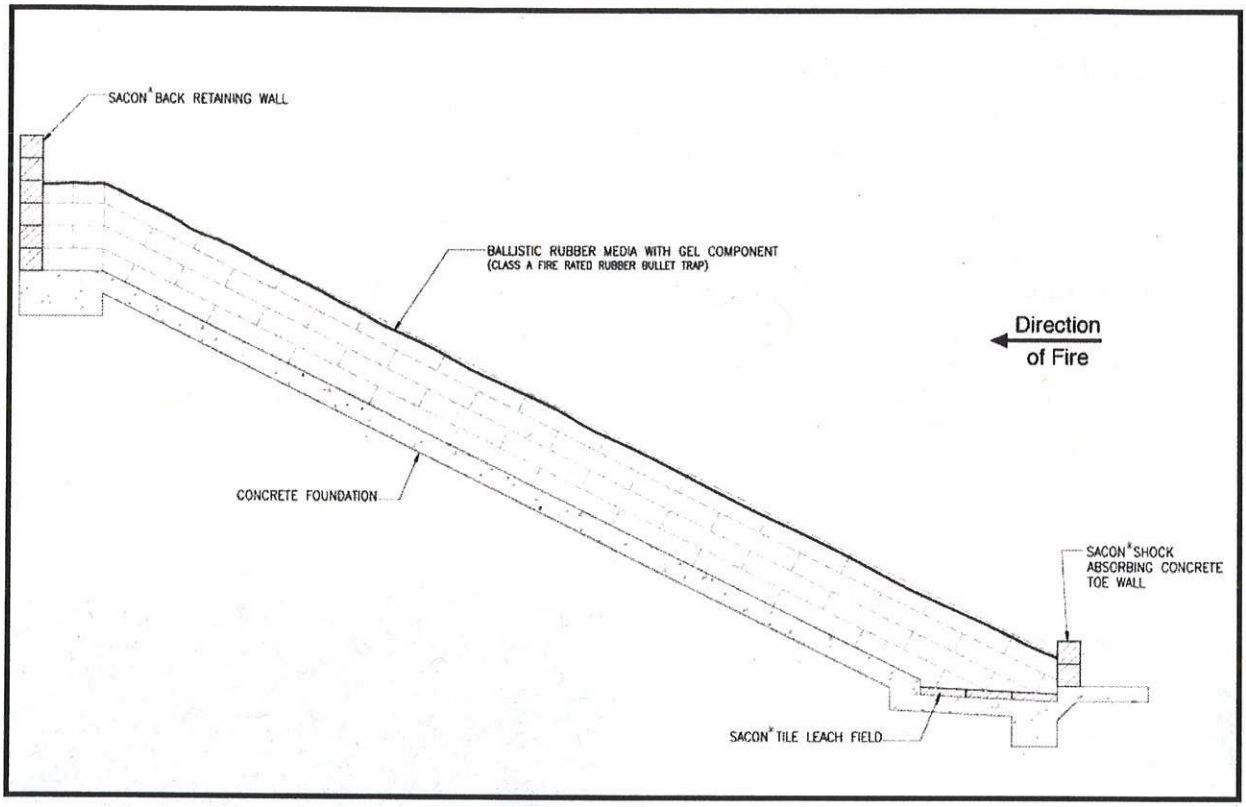
The bullet containment designs in this appendix are sample designs for the containment systems mentioned in this manual. Design systems may vary from different manufacturers. Reference to various individual bullet containment devices is included in this manual for informational purposes only. EPA does not endorse any particular bullet containment device, design, or product.



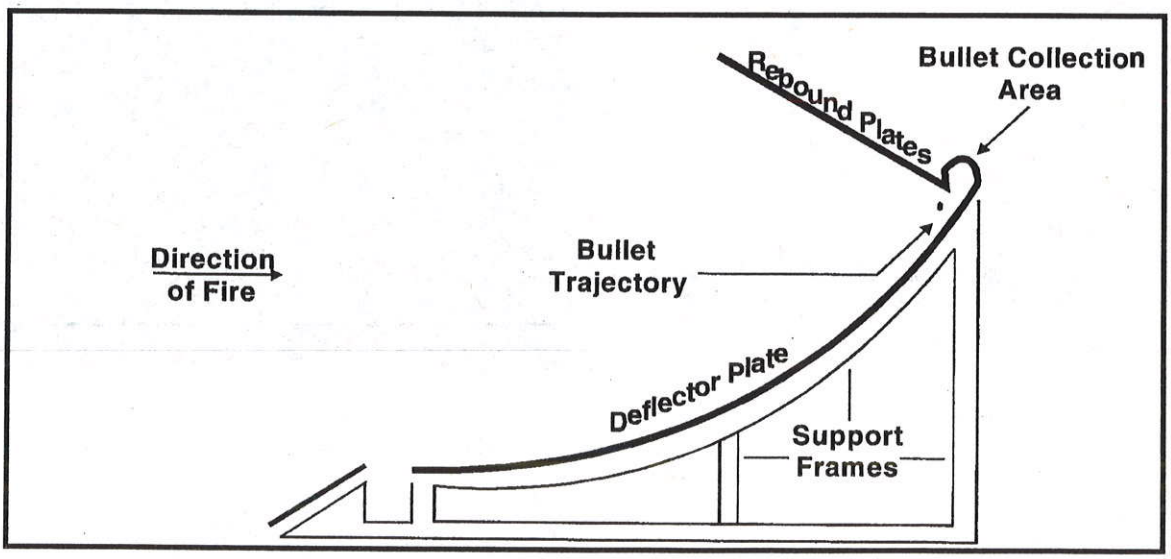
Sand Trap



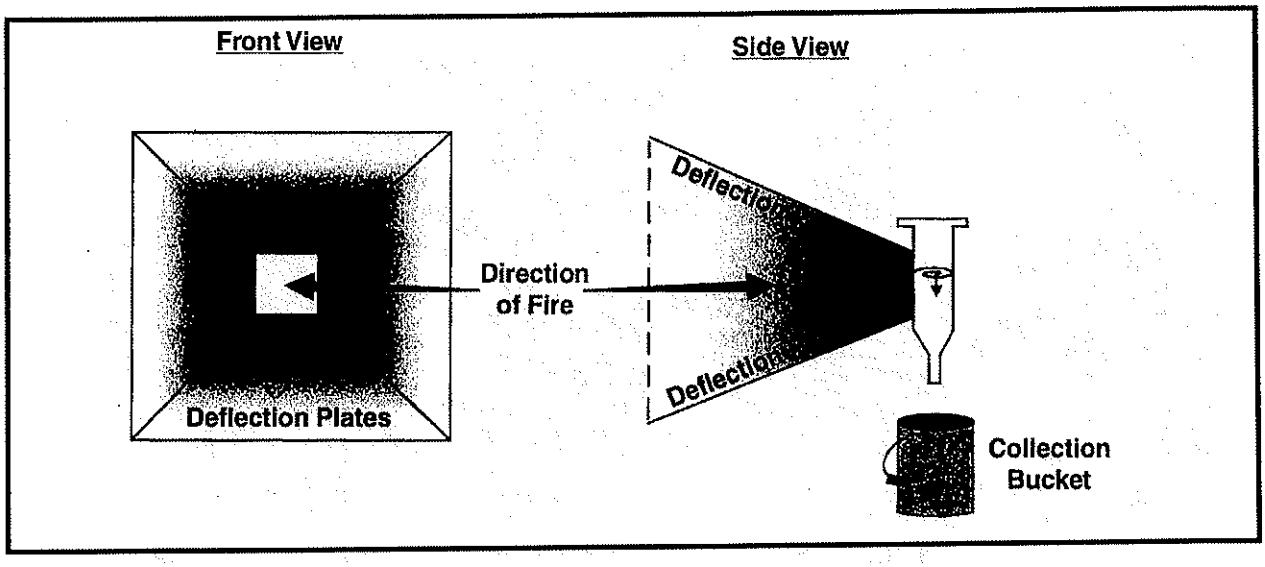
Rubber Granule Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



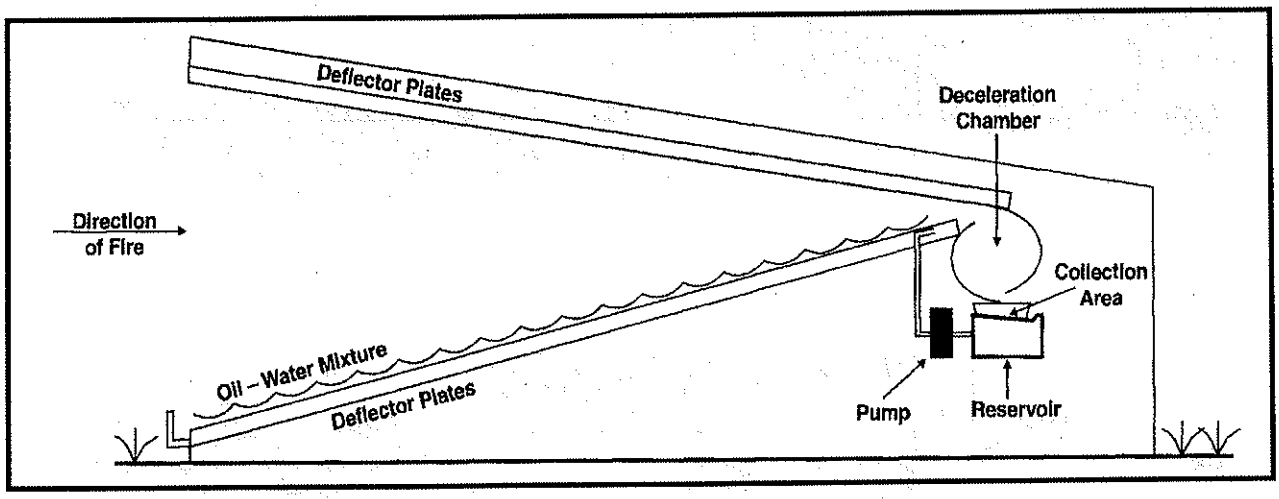
Gel-Cor Bullet Trap™ (Provided by Super Trap, Inc.)



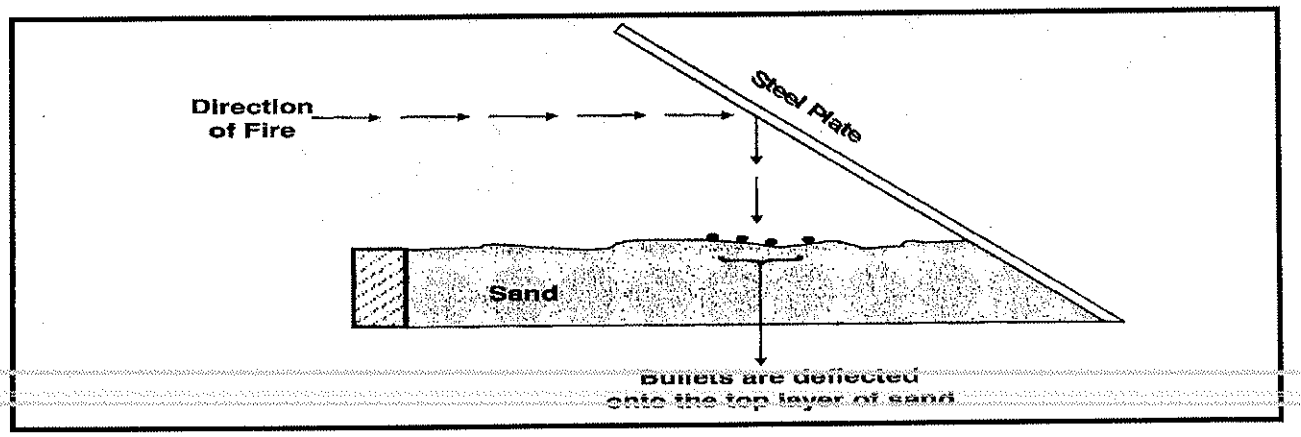
Escalator Trap (Adapted from: *Bullet Trap Technologies*, Action Target Educational Video Series)



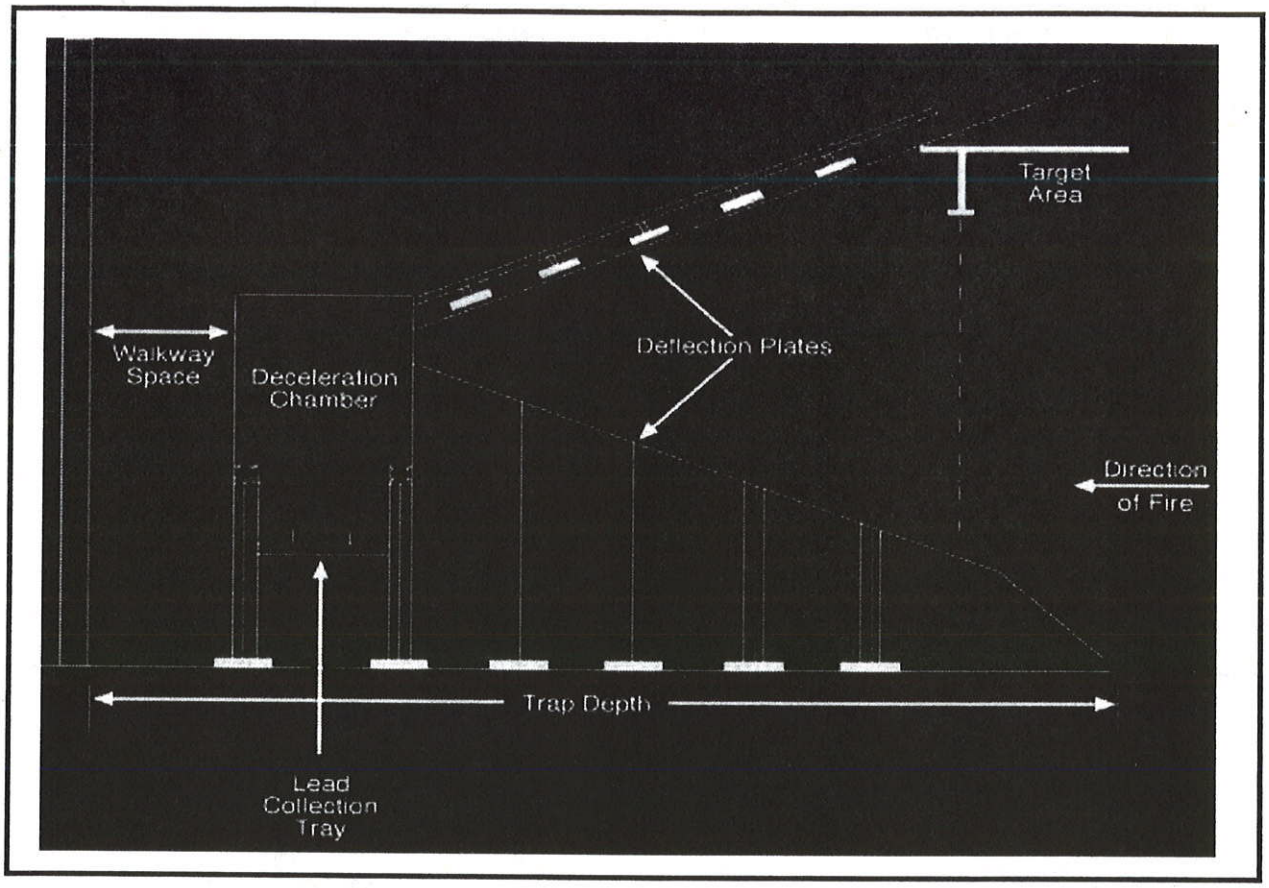
Vertical Swirl Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



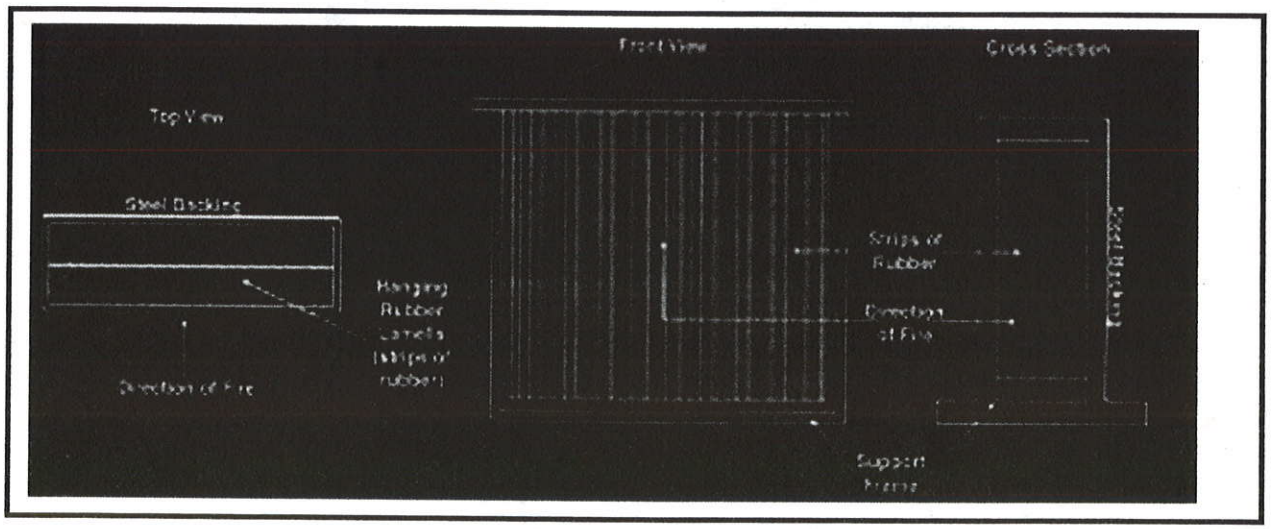
Wet Passive Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



Pitt and Plate (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



Steel Bullet Trap (Adapted from: *Bullet Trap Technologies*, Action Target Educational Video Series)



Lamella Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)

Appendix D: RCRA Regulatory Requirements and Interpretations

Timely separation of lead shot and bullets from soil at active ranges, recycling of the lead, and subsequent redeposition of the soil on the active range is exempt from RCRA regulation.

1. Reclaiming and Recycling Lead Shot

EPA's Office of Solid Waste issued guidance in 1997 indicating that lead shot, when recycled, is considered a scrap metal and is therefore exempt from RCRA regulation. A copy of the March 17, 1997 letter with this guidance is attached. Under the RCRA Subtitle C hazardous waste management regulations, lead shot would be considered scrap metal, which is exempt from hazardous waste regulations if it is recycled (see 40 CFR 261.6(a)(3)(ii)). Although storage of scrap metal being recycled is not affected by specific time limits such as the speculative accumulation provision (40 CFR 261.1(b)(8)), the scrap metal must legitimately be recycled to remain exempt under this provision. It should also be noted that lead shot may be subject to the authority of RCRA 7003, which addresses imminent hazards. However, use of best management practices is likely to prevent situations which would present an imminent hazard. Using such practices, together with following a clear, written policy governing the facility's recycling efforts, should also assist in assuring that the facility's practices can be demonstrated to be legitimate recycling.

2. Storage of Lead on Shooting Ranges Prior to Recycling

Some ranges have indicated that it may be desirable to store recovered lead shot and bullets on the range property for some periods of time prior to sale for recycling.

Provided that best management practices are followed in terms of storing and recycling the sorted lead, a range that follows such practices, and engages in legitimate recycling, should be able to store such material prior to recycling without RCRA regulatory controls (see discussion below). Best practices would suggest that the sorted lead, at a minimum, should not be exposed to the elements and should be managed so as to prevent releases to the environment. Best practices also indicate that the sorted lead should be stored in containers in good condition, regular inspections of the container condition should be conducted, and the records of inspections should be maintained and be readily available. Further, best practices also suggest that the sorted lead should be recycled in a timely manner and storage times should not exceed the time-frames or goals articulated in a clear, written policy.

3. Placement of Soil After Removal of Lead

For soil placed back on an active range after a BMP has been applied to remove the lead, the following regulatory approach has been followed. On February 12, 1997, EPA published the RCRA Subtitle C Military Munitions Rule in the Federal Register (62 Fed. Reg. 6621). The Military Munitions Rule considers range management to be a necessary part of the safe use of munitions for their intended purpose. Thus, the range clearance activity (recovery of lead shot and bullets) is an intrinsic part of the range operation. Therefore, the rule excludes range clearance activities (including the placement of soil back on the range) from RCRA Subtitle C regulation. Although the Military Munitions Rule did not apply to non-military ranges, EPA, in its response to comments on the proposed rule, clearly stated that "it felt that the 'range clearance' interpretation in the final Military Munitions Rule is consistent with the EPA's interpretations for non-military ranges." In addition, the EPA's Director of the Office of Solid Waste sent the New York State Department of Environmental Conservation a letter dated April 29,1997, confirming that the Military Munitions Rule range clearance principles apply equally to non-military ranges. A copy of the letter is attached.

4. Relocation of Backstop and Shotfall Zone Soil

Some ranges have indicated to the EPA that it may be desirable to transport and/or relocate a backstop in order to reorient or modify their range. This may occur when there is a need to reorient the range due to environmental concerns (e.g., shooting over water (wetland, stream, pond) or excessive runoff), alter the layout to improve shooter safety, or redesign to modify shooting conditions (e.g., adjusting number of shooting positions, increasing or decreasing target distance.) In some cases backstop material would not be moved off the range property, but to another area on the range property.

EPA's position is that range backstop materials are part of the range and are not wastes when they are moved or relocated, as long as the range continues to be used as a range and the backstop materials continue to be used as backstop materials. Hence, backstop materials that are still in use are not subject to the RCRA hazardous waste management regulations and need not be tested for hazardous waste characteristics. However, removal of lead from backstop materials that are to be relocated or moved is a normal practice of good range management in that it extends the usable life of the materials and reduces the possibility of releases of lead into the environment. If lead removal does not occur before moving the backstop material, the lead will become more dispersed throughout the material during movement and will thus be more difficult to recover in future reclamation events.

As a range management practice, it is environmentally preferable to use soil that may already contain lead and is on an active portion of the range, which will therefore undergo regular lead reclamation in the future, than to leave such soil in place and construct a new backstop with lead-free soil. Records of all movements of berm and shotfall zone soils, along with corresponding site plans, should be maintained indefinitely, as they will be necessary in evaluating cleanup needs during subsequent construction or range closure.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
March 17, 1997

Mr. Duncan Campbell
Environmental Protection Agency, Region V
RCRA Enforcement
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Dear Mr. Campbell:

Enclosed please find a memorandum on the regulatory status of lead shot, which includes a general discussion on the regulatory status of lead shot as scrap metal. I hope that this information is sufficient to address your specific concerns as they relate to the pile of lead shot at the Saxon Metals facility.

If you have any questions or would like to discuss this matter further, please contact me at (703) 308-8826.

Sincerely,
Jeffery S. Hannapel
Office of Solid Waste

Enclosure

To: Duncan Campbell, EPA Region V
From: Jeff Hannapel, EPA Office of Solid Waste
Date: March 13, 1997
Re: Regulatory Status of Lead Shot

Based on our conversations, it is my understanding that Saxon Metals received for recycling a shipment of approximately 30,000 pounds of lead shot from a commercial indoor shooting range. Smokeless gun powder is, presumably, commingled with the lead shot. The mixture appears to exhibit the ignitability characteristic of hazardous waste (as evidenced by the incident in which the material ignited when Saxon Metals was attempting to load it into the furnace with a front-end loader). You have asked our office to provide you with guidance on the regulatory status of the lead shot portion of the mixture, specifically whether it is considered a spent material or scrap metal.

The Agency has taken the position that the discharge of ammunition or lead shot does not constitute hazardous waste disposal because the Agency does not consider the rounds from the weapons to be "discarded." As you know, discard is a necessary criterion to be met

before a material can be considered a solid waste and subsequently a hazardous waste. (40 CFR §261.2(a).) The Agency's interpretation regarding discard is based on the fact that shooting is in the normal and expected use pattern of the manufactured product, i.e., the lead shot. Enclosed for your information is a September 6, 1988 letter from EPA to IDEM on this particular point.

In the federal regulations, the term, "scrap metal," is defined as "bits and pieces of metal parts (e.g., bars, turnings, rods, sheets, wire) or metal pieces that may be combined together with bolts or soldering (e.g., radiators, scrap automobiles, railroad box cars), which when worn or superfluous can be recycled." (40 C.F.R. §261.1.) In the Federal Register preamble for the final regulations on the definition of solid waste, EPA indicated that "scrap metal is defined as products made of metal that become worn out (or are off-specification) and are recycled to recover their metal content, or metal pieces that are generated from machine operations (i.e., turnings, stampings, etc.) which are recycled to recover metal." (50 Fed. Reg. 614, 624 (1985).) The lead shot portion of the Saxon Metals pile would be considered scrap metal pursuant to the regulatory definition of scrap metal.

EPA provided further clarification on the regulatory status of scrap metal in the Federal Register preamble to the definition of solid waste final regulations:

> [a]t proposal, scrap metal that was generated as a result of use by consumers (copper wire scrap, for example) was defined as a spent material. (This type of scrap is usually referred to as "obsolete scrap.") Scrap from metal processing, on the other hand (such as turnings from machining operations) was defined as a by-product. (It is usually called "prompt scrap.") Yet the scrap metal in both cases is physically identical (i.e., the composition and hazard of both by-product and spent scrap is essentially the same) and, when recycled is recycled in the same way - by being utilized for metal recovery (generally in a secondary smelting operation). In light of the physical similarity and identical means of recycling of prompt scrap and obsolete scrap, the Agency has determined that all scrap metal should be classified the same way for regulatory purposes. Rather than squeeze scrap metal into either the spent material or by-product category, we have placed it in its own category.

(50 Fed. Reg. at p. 624) Based on these regulatory passages, the lead shot portion of the pile would be considered scrap metal, and not a spent material. The lead shot is a product that is made of metal that can be recycled to recover metal content. Furthermore, the lead shot has not been "discarded" by virtue of its discharge at the shooting range, because the discharge is within the normal and expected use pattern of the manufactured product. Accordingly, lead shot would be considered scrap metal for regulatory purposes. Scrap metal is a solid waste, but it is exempt from the regulatory requirements of Subtitle C when it is recycled. (40 C.F.R. §261.6(a)(3)(ii).) As part of the Phase IV land disposal restrictions supplemental rulemaking (which was proposed January 25, 1996 and is expected to be finalized in April 1997), processed scrap metal and two categories of unprocessed scrap metal that is being recycled would be excluded from RCRA jurisdiction.

Please note that this discussion of the regulatory status is limited to the lead shot portion of the pile as you requested. To the extent that the entire pile exhibits the ignitability or reactive characteristic of hazardous waste, the mixture of materials would be considered hazardous waste and not scrap metal. The scrap metal designation for the lead shot would be applicable only to the extent that the lead shot could be segregated from the other materials in the pile.

I hope that this guidance on the regulatory status of lead shot recovered from shooting ranges provides you with the clarification that you needed. If you have any questions or would like to discuss this matter further, please contact me.

This page intentionally left blank

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
APR 29 1997

Mr. John P.Cahill
Acting Commissioner
State of New York
Department of Environmental Conservation
Albany, New York 12233-1010

Dear Mr. Cahill:

Thank you for your letter of April 3, 1997 to Administrator Browner requesting a clarification of the Environmental Protection Agency (EPA) Final Military Munitions Rule regarding the extension of its range clearance principles to non-military ranges. Although the final rule addresses only military ranges, we agree with your view that the range clearance principles apply equally to non-military ranges [see comment no. 5 on page 36 of the enclosed excerpt from the Military Munitions Final Rule Response to Comments Background Document].

We are aware of the State of New York's active leadership role in the clean-up of private firing ranges. We appreciate your writing in support of the range clearance aspects of the final Military Munitions Rule and we will consider your suggestions that we issue broader guidance on the applicability of its principles to non-military ranges.

Sincerely yours,

Elizabeth Cotsworth, Acting Director
Office of Solid Waste

Enclosure

This page intentionally left blank

Appendix E: Template for an Environmental Stewardship Plan for Management of Lead Shot/Bullets

Instructions

EPA encourages outdoor shooting ranges to adopt and implement the Best Management Practices (BMPs) found in this manual. To this end, it is recommended that ranges first prepare an Environmental Stewardship Plan (ESP or Plan), which gathers information about, and guides evaluation of, site specific conditions of each range. As such, the ESP assists in selection of appropriate BMPs.

This document serves as a template that may be used by sportsmen's clubs and shooting ranges in their preparation of an ESP. This template was adapted from Appendix C of the National Shooting Sports Foundation's manual, *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges* (the NSSF manual.) This template is only a tool to assist in making ESP preparation easier and can, and in some cases should, be modified to incorporate specific information relative to your club and its ranges. It is intended to be used in conjunction with a full understanding of the NSSF, U.S. Environmental Protection Agency (EPA) and, for ranges in Florida, Florida Department of Environmental Protection (DEP) manuals for the safe management of lead at outdoor shooting ranges. This template is intended to encourage ranges to prepare ESPs and submit them to EPA or NSSF to obtain a Certificate of Recognition from EPA. In this regard, either the following template or the NSSF template is recommended for use in conjunction with EPA's Certificate of Recognition program.

An electronic copy of this template is available on EPA's shooting range website (http://www.epa.gov/region2/leadshot) in several formats.

Disclaimer: This template does not serve as a substitute for understanding the concepts and techniques discussed in the EPA manual or other manuals. This template is not to be used as a substitute for consultation with scientists, engineers, attorneys, other professionals, or U.S. EPA.

This page intentionally left blank

Environmental Stewardship Plan for Management of Lead/Bullets at Outdoor Shooting Ranges

Club Name

Address
City/Town, State & Zip Code
Phone #:

Date

Table of Contents

Table of Contents (continued)

Introduction

The XYZ Club, Inc. is located at 123 X Road in Anytown, USA…

Mission Statement

The XYZ Club, Inc. is committed to…

- *Purpose*:

The Purpose of this Environmental Stewardship Plan (i.e., the Plan) is to:

- Identify potential environmental concerns that may exist;
- Identify, evaluate, and prioritize appropriate actions to manage lead shot and bullets safely, as well as identifying and addressing environmental concerns;
- List short- and long-term steps needed for implementation;
- Develop an implementation schedule;
- Identify ways to measure the Plan's success;
- Evaluate annual progress made towards achieving environmental stewardship goals;
- etc.

- *Goal* – To minimize the release of lead into the environment.

Activities to Reach Goal:
Examples include:

▷ Avoid shooting over and into water and wetlands.
▷ Prevent off-site migration of lead through groundwater and surface water runoff.
▷ Conduct lead recovery.
▷ Discourage ingestion of lead by wildlife.
▷ Maintain soil pH between 6.5 and 8.5 in the shotfall zone.

Site Assessment

Description of Ranges and Support Facilities

The XYZ Club has an x position Trap Range, a y position Skeet Range, a z position Sporting Clays Course, and a q position Small Arms Range. These ranges are located in a rural setting and are oriented away from residential areas and surface water bodies.

[Briefly describe each range, its dimensions, orientation, vegetative cover, numbers of shooters and targets used per year, wildlife usage, etc.]

Existing Environmental Conditions

[Describe any known environmental conditions associated with the ranges. This might include type of soil, depth to groundwater, soil pH, drainage to surface water, unique animal or bird populations, etc. Refer to figures, tables, the results of surveys, inspections, professional opinions, etc.]

- *Trap and Skeet Fields*

- *Sporting Clays Course*

- *Rifle and Black Powder Range(s)*

- *Outdoor Handgun Range(s)*

Trap and Skeet Fields

Action Plan

[Briefly describe the management options selected.]

- *Potentially Applicable Management Options*

[See EPA or NSSF guidance manual for full listing of options]

Examples include:
- Vegetate sparse grass area of trap/skeet field.
- Reorient trap field to avoid lead shot entering wetlands.
- Reorient sporting clays stations to maximize the overlap of falling shot into the open field where it can be more easily recovered for recycling.
- Limit use of the trap/skeet range to only those stations that do not have wetland area within the shotfall zone.
- Apply lime to shotfall zones if soil test results indicate this would be beneficial.
- Prepare fields for lead reclamation.
- Get bids for lead reclamation project.
- Conduct lead reclamation within the trap/skeet shotfall zones.
- Change mowing frequency to closely mow grass in shotfall zones.
- Construct lean-tos at backstop berms.
- Construct a lime lined drainage swale for stormwater management.
- List additional Best Management Practices that may be appropriate to your club.

In addition to appropriate site-specific management options, the list should always include conducting lead reclamation within the berm for rifle and pistol ranges and conducting lead reclamation within the trap, skeet, and sporting clays shotfall zones.

- *Selection of Management Options to be Implemented*

Option x:
Option y:
Option z:

[Describe why the above options were selected and the general roles of club officers, the membership, and outside consultants, as applicable, in implementation.]

In order to implement the options selected, the following actions are necessary.

a) Management Actions: [Examples include: assign personnel responsible for initiating, conducting, and completing the alternatives selected above.]
b) Operational Actions: [Examples include: collect soil samples for pH analysis, consult with USDA's Natural Resources Conservation Service and/or the county Cooperative Extension Service regarding best suited vegetative management recommendations.]
c) Construction Actions: [Examples include: do site preparation work, get bids, institute mowing and vegetative management recommendations, reorient shooting position as appropriate.]

Plan Implementation

- *Schedule for Implementation*

Winter/Spring: [Examples include: pH survey, contact local officials for vegetation management recommendations, reorient shooting positions as appropriate, realign shooting positions as appropriate.]

Summer/Fall: [Examples include: prepare site for reclamation project, apply lime/fertilizer/seed, get bids for berm lean-tos/reclamation. As a rule of thumb, 50 pounds of lime per 1,000 square feet should raise soil pH by 1 once the residual acidity is overcome.]

- *Responsibilities*

[Specific duties (i.e., the trap/skeet chairman/chairmen will..., The club treasurer will..., The membership will provide the labor to...)]

Rifle, Black Powder, and Outdoor Handgun Range(s)

Action Plan

[Briefly describe the management options selected.]

Potentially Applicable Management Options

[See EPA or NSSF guidance manual for full listing of options]

Examples include:
- Culvert the stream through the shooting ranges.
- Vegetate the backstop berm(s) to minimize erosion.
- Construct a lime lined drainage swale for stormwater management.
- Apply lime to the berm and foreground if pH test determines it is necessary.
- Begin planning a lead reclamation project.
- Construct lean-tos at berms.
- List additional Best Management Practices that may be appropriate to your club.

Selection of Management Options to be Implemented

Option x:
Option y:
Option z:

[Describe why the above options were selected and the general roles of club officers, the membership, and outside consultants, as applicable, in implementation.]

In order to implement the options selected, the following actions are necessary.

a) Management Actions: [examples include: assign personnel responsible for initiating, conducting, and completing the alternatives selected above.]
b) Operational Actions: [examples include: collect soil samples for pH analysis, consult with USDA's Natural Resources Conservation Service and/or the county Service Forester regarding best suited vegetative management recommendations.]
c) Construction Actions: [examples include: do site preparation work, get bids, institute mowing and vegetative management recommendations, reorient shooting position as appropriate.]

Plan Implementation

- *Schedule for Implementation*

Winter/Spring: [examples include: pH survey, contact local officials for vegetation management recommendations, reorient shooting positions as appropriate, realign shooting positions as appropriate.]

Summer/Fall: [examples include: prepare site for reclamation project, apply lime/fertilizer/seed, get bids for berm lean-tos/reclamation.]

- *Responsibilities*

[Specific duties (i.e.: the small arms range chairman/chairmen will...,The club treasurer will..., The membership will provide the labor to...)]

Sporting Clays Course

Action Plan

- *Potentially Applicable Management Options*

[See EPA or NSSF guidance manual for full listing of options]

- *Selection of Management Options to be Implemented*

- *Options Selected*

Plan Implementation

- *Schedule for Implementation*

- *Responsibilities*

Measuring Success

By monitoring the success of the Plan, the club is best prepared to make whatever changes may be necessary to reinforce success and make the most of environmental stewardship efforts. Below are some examples of areas to monitor:

Lead Recovery

[Document the quantity (pounds) of lead recovered and recycled, along with the cost of conducting the activities.]

Vegetation

[The density of vegetation growth should be measured throughout the growing season, especially in areas of sparse growth where steps have been taken to increase the vegetative cover. This is can be done by taking periodic photographs (e.g., once a month) from the same places to document the impact of the Plan.]

Wildlife

[Keep a log of visual observations made regarding the frequency of range usage by the variety of species in your area.]

Soil and Runoff pH

[Track soil and runoff pH through semiannual monitoring and adjust the amount of lime applied to different areas of the range to maintain a pH level that will prevent lead from dissolving (i.e., a pH of 6.5-8.5).]

Erosion

[Again, keeping a photographic record of problem areas best prepares your club to document achievements and adjust the Plan as appropriate.]

Plan Review and Revisions

Review the Plan on an annual basis. Update the Plan as needed and schedule activities for subsequent years. Make recommendations for future club officers to consider when updating the Plan and designating future activities to be conducted (tell them what worked, what didn't work, and what still needs to be done.)

FIGURES

Figure 1
Facility diagrams

Figure 2
Resource maps (USGS topographic map, wetlands maps, soil survey maps, FEMA floodplain map, etc.)

Figure 3 (Optional)
Site photographs

Figure 4 (Optional)
Aerial photo of range and surrounding area

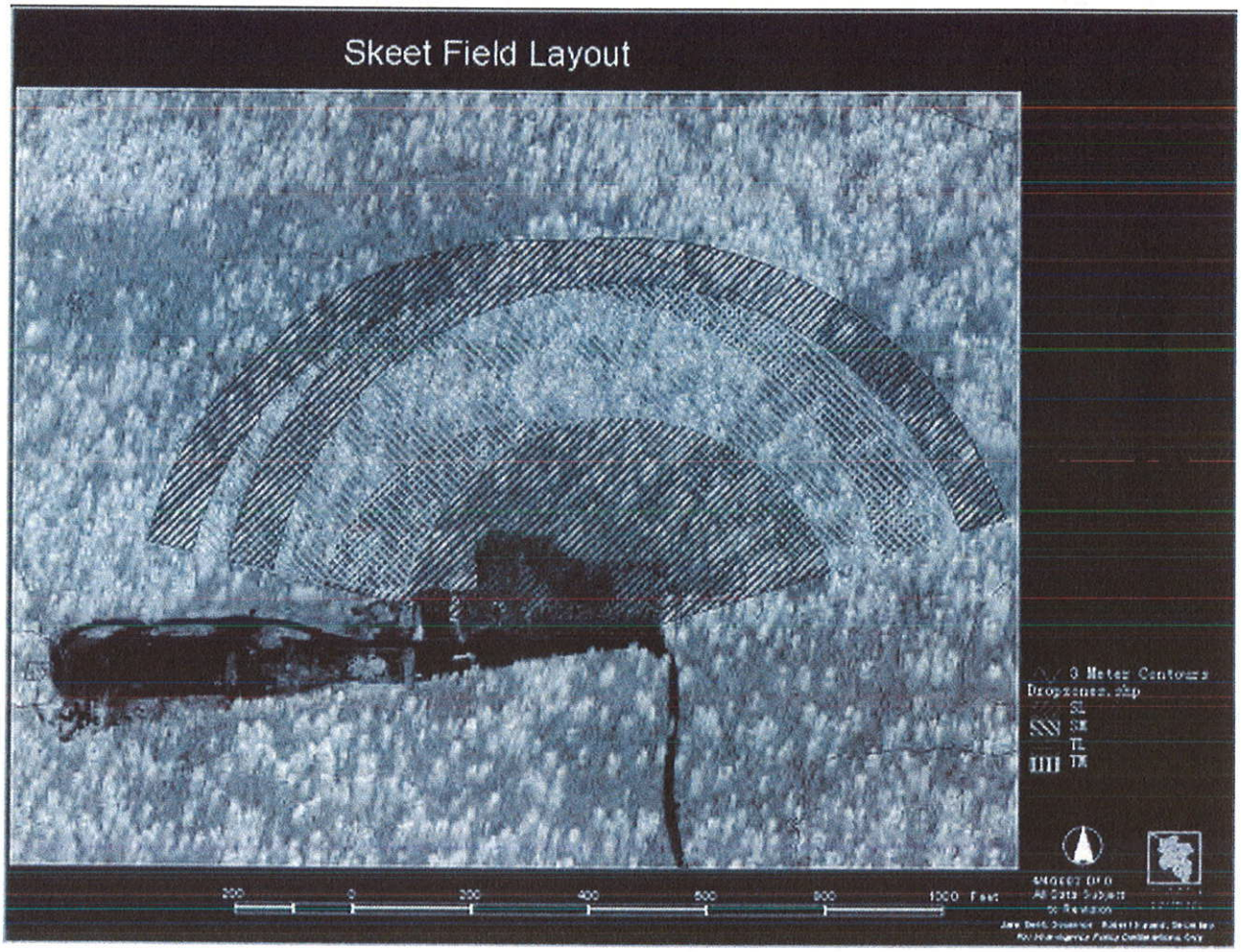
Appendix A
(Optional)

Appendix B
(Optional)

[Insert other figures as necessary to support the text]

Other figures may include an aerial photograph, and sketches of the Club property in general and/or specific ranges in particular.

Example:



[Insert Site Location Map Here]

Typically, a Site Location Map is cut from a USGS Topographic Map of you Club's area. The Club should be centered on the map. Indicate the property boundaries and layout of the range.

Appendix A

Information from USDA, Natural Resources Conservation Service [and/or county Cooperative Extension Service]

[concerning soil and vegetation management recommendations]

Appendix B (etc.)
[For other supporting documentation as needed.]

U.S. Environmental
Protection Agency
Region 2

EPA-902-B-01-001
Revised June 2005

United States Environmental Protection Agency
290 Broadway
New York, NY 10007-1866
Official Business
Penalty for Private Use $300
Forwarding and Address
Correction Requested

FIRST-CLASS MAIL
U.S. POSTAGE
PAID
MAILED FROM ZIP CODE 10007
PERMIT NO. G-35

DELAWARE RIVERKEEPER®

May 16, 2013

Shawn M. Garvin
Regional Administrator
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103-2029
Region III

Re: Supplement to CERCLA Section 105(d) Petition for Preliminary Assessment of the Philadelphia Gun Club Site at 3051 State Road, Bensalem, Pennsylvania 19020

Dear Regional Administrator Garvin,

On April 23, 2013, Maya K. van Rossum, as the Delaware Riverkeeper, and on behalf of the Delaware Riverkeeper Network (collectively "DRN"), submitted a CERCLA Section 105(d) petition to you requesting that Region III of the U.S. EPA conduct a preliminary assessment of the release of lead into soil, groundwater, and surface water resulting from decades of lead shot accumulation at the Philadelphia Gun Club (PGC) trap shooting range in Bensalem, Pennsylvania. DRN seeks to supplement the petition with additional data showing that soil lead concentrations at locations outside, but directly adjacent to the boundaries of the PGC site, are as high as **2000 mg/kg**. DRN would also like to request a meeting to discuss our concerns regarding the potential impact of lead contamination at the PGC site on human health and wildlife.

As explained in the petition, because PGC concedes that its members used lead shot during shooting activities occurring from 1880 through 1994 at the range, which is located

DELAWARE RIVERKEEPER NETWORK
925 Canal Street, Suite 3701
Bristol, PA 19007
Office: (215) 369-1188
fax: (215)369-1181
drn@delawareriverkeeper.org
www.delawareriverkeeper.org

immediately adjacent to the Delaware River, DRN is concerned that residual lead shot accumulated at the ground surface of the shooting range over the course of at least **114 years** of regularly conducted shooting activities may presently be releasing lead to near surface soils, groundwater, and surface waters. DRN supported the petition with the results of preliminary sampling from the shoreline adjacent to the PGC site, which showed near surface soil lead concentrations as high as 1200 mg/kg at locations immediately outside the perimeter of the PGC site.

After DRN submitted its petition, the results of additional soil sampling conducted at DRN's request by an independent contractor, GeoSystems Consultants, Inc. ("GeoSystems"), on March 27-28, 2013 became available to DRN.

During the March 27-28 sampling event, GeoSystems collected soil samples from 17 locations at the perimeter of the PGC site. As shown on the attached Figure 1, GeoSystems collected these samples along the shoreline of the PGC site, just below the low tide line, in order to avoid any possible trespass on PGC property. At each sampling location, a clean Shelby tube was used to collect the top 6 to 8 inches of soil. GeoSystems composited the samples from each location and sieved them in accordance with EPA guidance documents on soil lead sampling at shooting range sites.[1] For the soil from each sampling location, a No. 4 sieve was used to remove gravel and large debris from the sample to obtain the total sample for lead testing. A No. 4 sieve was used for this purpose so that any intact shot pellets in the soil would pass through the sieve and become part of the total sample tested for lead. Approximately 100 grams of the material passing through the No.4 sieve was placed in lab-provided glassware prior to sieving the

[1] *See* U.S. E.P.A., Office of Solid Waste and Emergency Response, *TRW Recommendations for Performing Human Health Risk Analysis on Small Arms Shooting Ranges*, OSWER #9285.7-37 (March 2003); U.S. E.P.A., Office of Solid Waste and Emergency Response, *Short Sheet: TRW Recommendations for Sampling and Analysis of Soil at Lead (Pb) Sites*, OSWER #9285.7-38 (April 2000).

remaining material through a No. 60 sieve to obtain the fine fraction. GeoSystems submitted 100 gram samples of the resulting total and fine fractions from each location to EMSL Analytical, Inc. in Cinnaminson, New Jersey for analysis for lead by EPA Solid Waste Test Method SW-846 7421.[2] DRN selected EPA Method 7421 in accordance with EPA guidance on soil lead assessment at shooting range sites.[3]

As per DRN's instructions, GeoSystems also collected soil samples at three locations below the low tide line on the shoreline of the Neshaminy State Park, approximately 2500 feet upriver from the PGC site. These samples were collected, processed, and tested in accordance with the same procedures as the samples collected adjacent to the PGC site. The purpose of this limited sampling at the Neshaminy State Park was to provide a rough baseline for comparison. The sample locations are shown on Figure 2, attached.

Lead Concentrations in Samples Collected March 27-28, 2013

As shown below in Table 1, lead concentrations in the fine fraction of soil samples collected near the PGC site ranged from 120 mg/kg to 2000 mg/kg. The mean concentration for the fine fraction from all samples was 784 mg/kg. The mean concentration for the subset of samples representing the eastern portion of the shoreline (locations H3 through Q3) was 1041 mg/kg.

Lead concentrations in the total sample (representing both the coarse and fine fractions combined) ranged from 83 mg/kg to 1400 mg/kg, with a mean of 478 mg/kg. The mean concentration for the subset of samples representing the eastern portion of the shoreline was 651 mg/kg.

---

[2] According to EPA's January 2013 National Lead Laboratory Accreditation Program List, EMSL Analytical is accredited to perform lead testing by both the American Association for Laboratory Accreditation and the American Industrial Hygiene Association.

[3] *See* U.S. E.P.A., Office of Solid Waste and Emergency Response, *TRW Recommendations for Performing Human Health Risk Analysis on Small Arms Shooting Ranges*, OSWER #9285.7-37 (March 2003).

Notably, because the 17 soil samples were collected from five to fifteen feet riverward of the low tide line, along a sloping shoreline, the concentrations may be skewed downward relative to on-site soil lead concentrations at the PGC range.

Table 1. Lead Concentrations in Samples from PGC Shoreline on the Delaware River

	Lead Concentration (mg/kg)	
Sample ID	FINE FRACTION	TOTAL SAMPLE
A3	260	110
B3	120	83
C3	Not Available[4]	130
D3	670	350
E3	420	390
F3	210	170
G3	460	390
H3	**2000**	**1400**
I3	410	290
J3	680	**820**
K3	**1100**	610
L3	370	430
M3	**950**	510
N3	**1800**	**1100**
O3	**970**	600
P3	430	190
Q3	**1700**	560
Mean	784	478
Mean Eastern Portion	1041	651

In contrast to the samples collected adjacent to the PGC site, the lead concentrations in samples collected upriver at the Neshaminy State Park ranged from 13 mg/kg to 48 mg/kg in the fine fraction, and 20 mg/kg to 54 mg/kg in the total sample, as shown in Table 2. The mean lead concentrations in the three park samples were 36 mg/kg (fine fraction) and 33 mg/kg (total).

[4] The surface soils at location C3 were predominantly coarse-grained sediments.

Table 2. Lead Concentrations in Comparative Samples from Neshaminy State Park

	Lead Concentration (mg/kg)	
Sample ID	FINE FRACTION	TOTAL SAMPLE
PRK1	48	54
PRK2	46	24
PRK3	13	20
Mean	36	33

The results of this March 27-28 soil sampling event provide additional support for DRN's petition that EPA conduct a preliminary assessment of the PGC site by showing that:

- Lead concentrations in the fine fraction of 35% of the samples exceeded the non-residential lead screening level of 800 mg/kg recommended by EPA[5];
- Lead concentrations in the fine fraction of 70% of the samples exceeded the residential lead screening level of 400 mg/kg recommended by EPA[6];
- Lead concentrations in the total sample for 18% of the samples exceeded the non-residential lead screening level of 800 mg/kg;
- Lead concentrations in the total sample for 47% of the samples exceeded the residential lead screening level of 400 mg/kg;
- The mean lead concentration for both the fine fraction (784 mg/kg) and total sample (478 mg/kg) exceeded the residential lead screening level of 400 mg/kg;
- The mean lead concentration of 1041 mg/kg in the fine fraction for the eastern portion of the shoreline exceeded the non-residential screening level of 800 mg/kg;

[5] *See* U.S. E.P.A., *Addressing Lead at Superfund Sites, Frequent Questions from Risk Assessors on the Adult Lead Methodology*, http://www.epa.gov/superfund/lead/almfaq.htm (last accessed Mar. 12, 2013).

[6] *See* U.S. E.P.A., *Office of Solid Waste and Emergency Response, Memorandum: OSWER Directive: Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER # 9355.4-12 (Aug 1994).

- The mean lead concentration in the fine fraction (784 mg/kg) was over *twenty times higher* than the mean concentration for samples collected upriver at the Neshaminy State Park (36 mg/kg);
- The mean lead concentration for the total sample (478 mg/kg) was over *fourteen times higher* than the mean concentration for samples collected upriver at the Neshaminy State Park (33 mg/kg).

DRN continues to be concerned that on-site lead concentrations in surface soils at the PGC shooting range may be far higher than that found in the samples collected from soils immediately adjacent to the site. It is our concern that the PGC site may be releasing considerable quantities of lead into groundwater and stormwater reaching the Delaware River. The results of the GeoSystems testing, viewed in light of the undisputed historical use of lead shot at the site for *at least* 114 years, demonstrate the need for a preliminary assessment of conditions at PGC's shooting range to evaluate whether on-site soil lead concentrations may pose a threat to human health or wildlife.

Sincerely,

Maya K. van Rossum

Maya K. van Rossum, the Delaware Riverkeeper
Delaware Riverkeeper Network
925 Canal Street, Suite 3701
Bristol, PA 19007
tel. 215-369-1188 ext. 102
fax 215-369-1181
keepermaya@delawareriverkeeper.org

encl

cc: Ronald Borsellino, Director
Hazardous Site Cleanup Division
U.S. Environmental Protection Agency, Region III
Mailcode: PM00
1650 Arch Street
Philadelphia, PA 19103-2029

Figure 1. Approximate Sampling Locations at PGC Shoreline Near Shooting Range

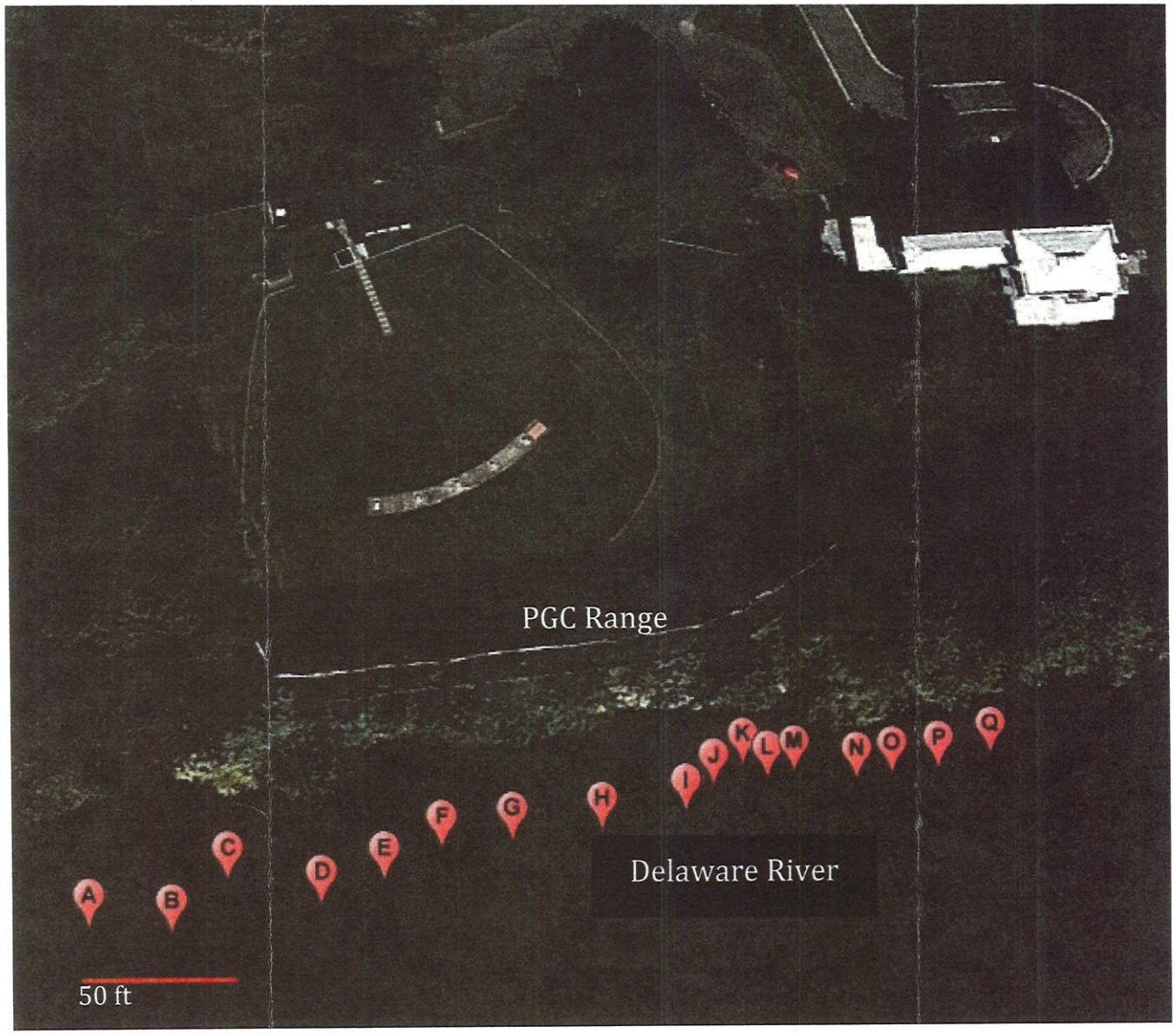
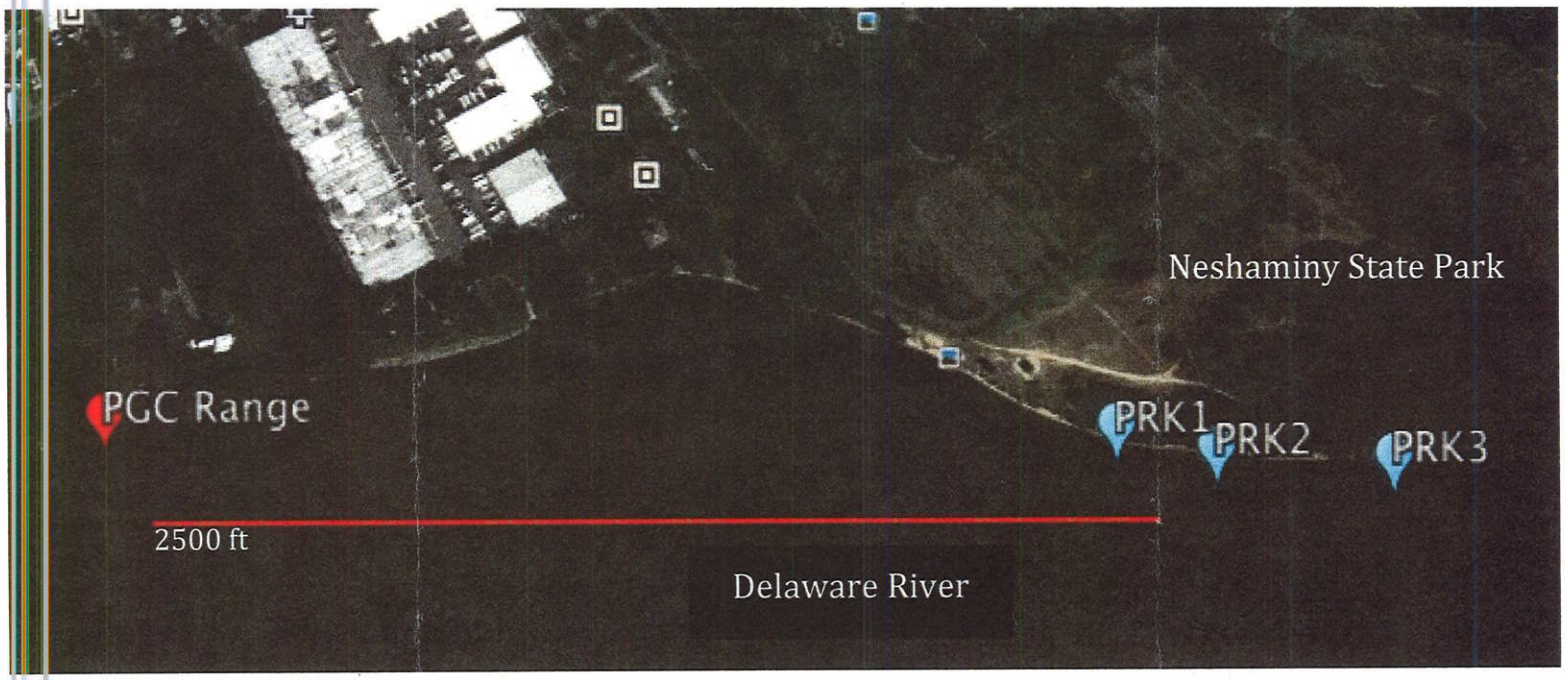


Figure 2. Approximate Sampling Locations for Comparative Samples at Neshaminy State Park



EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.emsl.com cinnaminsonleadlab@emsl.com

EMSL Order: 201303374
CustomerID: DRKN34A
CustomerPO:
ProjectID:

Attn: **Dave Harmanos**
GeoSystems Consultants Inc.
165 Indiana Ave.
Fort Washington, PA 19034

Phone: (215) 654-9600
Fax:
Received: 04/11/13 3:38 PM
Collected: 3/29/2013

Project: **2013 G320**

Test Report: Pb by Graphite Furnace Atomic Absorption

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
PRK 1	*0001*	3/28/2013	4/22/2013	54 mg/Kg
	Site: Passing #4			
PRK 1	*0002*	3/28/2013	4/22/2013	48 mg/Kg
	Site: Passing #60			
PRK 2	*0003*	3/28/2013	4/22/2013	24 mg/Kg
	Site: Passing #4			
PRK 2	*0004*	3/28/2013	4/22/2013	46 mg/Kg
	Site: Passing #60			
PRK 3	*0005*	3/28/2013	4/22/2013	20 mg/Kg
	Site: Passing #4			
PRK 3	*0006*	3/28/2013	4/22/2013	13 mg/Kg
	Site: Passing #60			
A3	*0007*	3/27/2013	4/22/2013	110 mg/Kg
	Site: Passing #4			
A3	*0008*	3/27/2013	4/22/2013	260 mg/Kg
	Site: Passing #60			
B3	*0009*	3/27/2013	4/22/2013	83 mg/Kg
	Site: Passing #4			
B3	*0010*	3/27/2013	4/22/2013	120 mg/Kg
	Site: Passing #60			
C3	*0011*	3/27/2013	4/22/2013	130 mg/Kg
	Site: Passing #4			
D3	*0012*	3/27/2013	4/22/2013	350 mg/Kg
	Site: Passing #4			
D3	*0013*	3/27/2013	4/22/2013	670 mg/Kg
	Site: Passing #60			
E3	*0014*	3/29/2013	4/22/2013	390 mg/Kg
	Site: Passing #4			
E3	*0015*	3/29/2013	4/22/2013	420 mg/Kg
	Site: Passing #60			

Julie Smith - Laboratory Director
NJ-NELAP Accredited:03036
or other approved signatory

Reporting limit is 40 mg/kg based on a 0.5 gram sample weight. The QC data associated with these sample results included in this report meet the method quality control requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. "<" (less than) result signifies that the analyte was not detected or at about the reporting limit.

* slight modifications to methods applied Samples received in good condition unless otherwise noted. Quality Control Data associated with this sample set is within acceptable limits, unless otherwise noted Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ

Initial report from 04/25/2013 17:18:04

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.emsl.com cinnaminsonleadlab@emsl.com

EMSL Order:	201303374
CustomerID:	DRKN34A
CustomerPO:	
ProjectID:	

Attn: **Dave Harmanos**
GeoSystems Consultants Inc.
165 Indiana Ave.
Fort Washington, PA 19034

Phone:	(215) 654-9600
Fax:	
Received:	04/11/13 3:38 PM
Collected:	3/29/2013

Project: **2013 G320**

Test Report: Pb by Graphite Furnace Atomic Absorption

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
F3	*0016*	3/29/2013	4/22/2013	170 mg/Kg
	Site: Passing #4			
F3	*0017*	3/29/2013	4/22/2013	210 mg/Kg
	Site: Passing #60			
G3	*0018*	3/29/2013	4/22/2013	390 mg/Kg
	Site: Passing #4			
G3	*0019*	3/29/2013	4/22/2013	460 mg/Kg
	Site: Passing #60			
H3	*0020*	3/29/2013	4/22/2013	1400 mg/Kg
	Site: Passing #4			
H3	*0021*	3/29/2013	4/18/2013	2000 mg/Kg
	Site: Passing #60			
I 3	*0022*	3/29/2013	4/18/2013	290 mg/Kg
	Site: Passing #4			
I 3	*0023*	3/29/2013	4/18/2013	410 mg/Kg
	Site: Passing #60			
J3	*0024*	3/27/2013	4/18/2013	820 mg/Kg
	Site: Passing #4			
J3	*0025*	3/27/2013	4/18/2013	680 mg/Kg
	Site: Passing #60			
K3	*0026*	3/27/2013	4/18/2013	610 mg/Kg
	Site: Passing #4			
K3	*0027*	3/27/2013	4/18/2013	1100 mg/Kg
	Site: Passing #60			
L3	*0028*	3/27/2013	4/22/2013	430 mg/Kg
	Site: Passing #4			
L3	*0029*	3/27/2013	4/22/2013	370 mg/Kg
	Site: Passing #60			
M3	*0030*	3/27/2013	4/22/2013	510 mg/Kg
	Site: Passing #4			

Julie Smith - Laboratory Director
NJ-NELAP Accredited:03036
or other approved signatory

Reporting limit is 40 mg/kg based on a 0.5 gram sample weight. The QC data associated with these sample results included in this report meet the method quality control requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected . This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. "<" (less than) result signifies that the analyte was not detected or at about the reporting limit.

* slight modifications to methods applied Samples received in good condition unless otherwise noted. Quality Control Data associated with this sample set is within acceptable limits, unless otherwise noted
Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ

Initial report from 04/25/2013 17:18:04

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.emsl.com cinnaminsonleadlab@emsl.com

EMSL Order:	201303374
CustomerID:	DRKN34A
CustomerPO:	
ProjectID:	

Attn: **Dave Harmanos**
GeoSystems Consultants Inc.
165 Indiana Ave.
Fort Washington, PA 19034

Phone: (215) 654-9600
Fax:
Received: 04/11/13 3:38 PM
Collected: 3/29/2013

Project: **2013 G320**

Test Report: Pb by Graphite Furnace Atomic Absorption

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
M3	*0031*	3/27/2013	4/22/2013	950 mg/Kg
	Site: Passing #60			
N3	*0032*	3/27/2013	4/22/2013	1100 mg/Kg
	Site: Passing #4			
N3	*0033*	3/27/2013	4/22/2013	1800 mg/Kg
	Site: Passing #60			
O3	*0034*	3/27/2013	4/22/2013	600 mg/Kg
	Site: Passing #4			
O3	*0035*	3/27/2013	4/22/2013	970 mg/Kg
	Site: Passing #60			
P3	*0036*	3/27/2013	4/22/2013	190 mg/Kg
	Site: Passing #4			
P3	*0037*	3/27/2013	4/22/2013	430 mg/Kg
	Site: Passing #60			
Q3	*0038*	3/27/2013	4/22/2013	560 mg/Kg
	Site: Passing #4			
Q3	*0039*	3/27/2013	4/22/2013	1700 mg/Kg
	Site: Passing #60			

Julie Smith - Laboratory Director
NJ-NELAP Accredited:03036
or other approved signatory

Reporting limit is 40 mg/kg based on a 0.5 gram sample weight. The QC data associated with these sample results included in this report meet the method quality control requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected . This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. "<" (less than) result signifies that the analyte was not detected or at about the reporting limit.

* slight modifications to methods applied Samples received in good condition unless otherwise noted. Quality Control Data associated with this sample set is within acceptable limits, unless otherwise noted

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ

Initial report from 04/25/2013 17:18:04